

A Concise Textbook of **Oral & Maxillofacial Surgery**



Forewords

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A Concise Textbook of Oral and Maxillofacial Surgery

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A Concise Textbook of Oral and Maxillofacial Surgery

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*Dedicated to
My father Mr Satyanarayan Sanghai
and my mother Mrs Sassi Sanghai,
for their continuous encouragement,
understanding and support*

Foreword

It is with great pleasure that I write this foreword for *Dr Sumit Sanghai*, an undergraduate student of mine who has done a commendable job of writing this book. A comprehensive coverage of the subject based on the syllabus of DCI along with a lucid representation makes it a valuable aid to BDS students in the subject of *Oral and Maxillofacial Surgery*. It is a concise compilation with self explanatory diagrams and well laid out tables. He has explained the subject in simple sentence structuring making it easier to comprehend the concepts, facts and procedures. The attractive outlay and organized presentation makes easy reading.

I wish him all the best, “*God Bless*”.



Ramdas Balakrishna

BDS, MDS

*Oral and Maxillofacial Surgeon and Implantologist,
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Foreword

The efforts that have gone into the compilation of this text is commendable. I congratulate these two young doctor, Dr Sumit Sanghai and Dr Parama Chatterjee for being a source of inspiration to numerous impressionable minds.



Deepika Kenkere

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FOREWORD

I wholeheartedly congratulate *Dr Sumit Sanghai* on his endeavour to bring out this edition of "*Concise Textbook of Oral and Maxillofacial Surgery*". Oral surgical procedures have been ingrained deeply into every sophisticated dental practice. This text fulfils the need for a concise and comprehensive book for the dental graduates. The uniqueness of this book lies in the sequential manner in which the chapters have been dealt with. I am sure that this edition will prove to be a valuable source of information for all dental graduates.

Arun Jacob Silas
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FOREWORD

I wholeheartedly congratulate *Dr Sumit Sanghai* for his sincere effort and hard work to bring out this edition of “*A Concise Textbook of Oral and Maxillofacial Surgery*”. I am sure this book shall be of a great help for all the dental students and graduates.

I wish him *All the Best*.

Uttam K Sen
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FOREWORD

I whole heartedly congratulate, *Dr Sumit Sanghai* and *Dr Parama Chatterjee* for their sincere efforts to take out this edition of “*A Concise Textbook of Oral and Maxillofacial Surgery*”. I foreword this book to all the young dental students, dental graduates and the dental fraternity. This book provides an academic excellence in the field of oral and maxillofacial surgery, with extensive point wise coverage of subject in an easy and lucid language.

I wish them “*All the very best*” for this new endeavour.

N Srinath

BDS, MDS, FDSRCS (Eng)

Comments

This simple and comprehensive Textbook on Oral and Maxillofacial Surgery put forward by Dr Sumit Sanghai and Dr Parama Chatterjee of my college is an ideal referral book for the dental undergraduates and also for general dentists in their day to day practice.

I wish them the best.



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Comments

I congratulate Dr Sumit Sanghai and Dr Parama Chatterjee for their endeavour. This book is concise but has a good coverage of all the topics necessary for the BDS student.

I wish them success.



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Comments

I congratulate *Dr Sumit Sanghai* and *Dr Parama Chatterjee* for taking such a huge step, it is indeed appreciable for the young sprouting doctors for taking such pain at this age to author a book like this. This textbook is truly concise and very helpful for the undergraduate students.

Dr. G.C. Veena

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Comments

I heartily congratulate *Dr Sumit Sanghai* and *Parama Chatterjee* for taking such a huge step. It is appreciable that they took such pain to author a book like this. The subject is truly very precise, the illustrations are clear and the whole text has been presented in a concise manner which should be very useful for undergraduate students. I wish them "*All the Best*".

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Preface

“TIME” has become a very important factor in today's education system in India. Students get a very scarce amount of time to even go through the various textbooks available and required for writing their examination in full confidence. We have tried to compile all the required information in one single text and in a concise manner so that the student can be confident to write his/her theory examination and viva-voce. This text has a number of tables which would help further revisions and easy learning. It has numerous diagrams that are all handdrawn so that the student can get a better understanding of the subject and can easily replicate it in his/her examination for better presentation. The coloured pictures even further enhance the understanding of the subject. For enthusiastic students we have added a list of reference at the end of each chapter as due to the concise format of the book, we have not included every minute details which are of less importance for undergraduate exam going students.

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We thank you “LORD” for giving us the strength and power to write this book.

We would like to thank our parents, Mr SN Sanghai, Mrs S Sanghai and Dr J Chatterji, Dr I Chatterji, our sister Mrs Gunjan Goel and our brother, Janak Chatterji, for their continuous support, help and encouragement.

We express our heart-felt appreciation to Dr Ramdas Balakrishna MDS, Department of Oral and Maxillofacial Surgery, Oxford Dental College and Hospital, Bangalore for taking out his precious time for helping us in proof-reading the text. We solicit our special thanks to Dr Arun Jacob MDS, Prof. and Head-Department of Pedodontics, Principal, Sri Rajiv Gandhi College of Dental Sciences and Hospital, Bangalore; Dr Deepika Kenkere MDS, Prof and Head-Department of Oral and Maxillofacial Surgery, Sri Rajiv Gandhi College of Dental Sciences and Hospital, Bangalore and Dr N Srinath MDS, Department of Oral and Maxillofacial Surgery, Krishnadenaraya College of Dental Sciences and Hospital, Bangalore for taking out their precious time among their busy schedule in providing us the required help, support and encouragement.

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We are thankful to our juniors, Prashanth and Monalisa for their help in completing the book.

We particularly thanks, Mr T Sounthar MLIS, MPhil, Chief Librarian, Sri Rajiv Gandhi College of Dental Sciences and Hospital, Bangalore for allowing us to enrich our knowledge by providing the required books and journals and also in preparing the soft copy of the book.

Lastly we would like to thank Mr Tarun Duneja, Director (Publishing), Jaypee Medical Publisher (P) Ltd, New Delhi for accepting our text for publication.



Sumit Sanghai



Parama Chatterjee

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Introduction to Oral and Maxillofacial Surgery

1

DEFINITION

Oral and maxillofacial surgery is a branch of Dentistry that deals with the art, diagnosis and treatment of various diseases, pathologies and defects involving the orofacial region.

PRINCIPLES OF SURGERY

The practice of surgery rests on certain fundamental principles which have to modify the technique to suit the anatomical field, the type of operation and the conditions obtaining at the time.

1. *Principles of painless surgery:* Anesthesia is indicated before any surgical procedure to avoid psychological and physical stress to the patient.
2. *Principles of asepsis:* It is the exclusion of micro-organism from operative field to prevent them from entering the wound. Proper preoperative and operative care should be taken to achieve proper asepsis.
3. *Principles of minimal damage:* Certain radical operations may regrettably require the sacrifice of vital structure but this does not often apply in oral surgery.
4. *Principles of adequate access:* This is achieved by the following:
 - i. *Incision and flap:* Cutting the skin or mucous membrane and dissecting through this incision to attain a flap. This

is done to gain adequate access to the surgical site.

- ii. *Cutting bone:* Burs, Chisels, Gouges, Rongeurs and files are used to cut and remove bone for gaining adequate access.
 - iii. *Retraction:* Retraction of the tissue layers divided by the incision and dissection is done to gain adequate access and protect tissues.
 - iv. *Cleaning the field of operation:* Fluid and loose debris must be cleaned from the field of operation by using dry gauge, cotton or suction.
5. *Principles of arrest of hemorrhage:* Hemorrhage can be arrested by following methods:
 - i. Digital pressure
 - ii. Hemostats or artery forceps
 - iii. Ligatures
 - iv. Packing
 - v. Posture
 - vi. Electrocoagulation
 - vii. Placing hot packs and bone wax over bleeding bone
 6. *Principles of debridement (toilet of wound):* This is done by cleaning the debris, pathological tissues, filling the tissue edge, removing the bone and tooth chips and finally irrigating the area using saline.

7. *Principles of drainage:* Wound are drained by following ways

- i. Fine superficial drains
- ii. Large superficial drains
- iii. Deep drains
- iv. Vacuum drains

Drains should be inserted into a cavity at its most dependent point and fixed in position for 2-3 days with regular examination.

8. *Principles of repair of wounds:* Before closure of wound is achieved the surgeon should be sure that the procedure was satisfactory, bleeding is arrested and

complete debridement is done. Wound closure is done by proper suturing the tissue ends.

9. *Principles of control and prevention of infection of wound:* Post-Operative infection is reduced by proper pre-operative preparation, an aseptic technique, minimal trauma and adequate drainage. Post-Operative tissues are protected by proper dressing and antibacterial therapy.

10. *Principles of support to the patient:* Pre and Post-operative care and general support of the patient is needed for the overall success of the surgical procedure.

Diagnosis in Oral and Maxillofacial Surgery

2

DEFINITION

Case History

It is a planned, professional conversation that enables patient to communicate symptoms, feeling, fears and sequence of events leading to problems to the clinician for which the patient seeks professional assistance.

Diagnosis

It is an explanation for the patient's symptoms and identification of other significant disease process.

Treatment Plan

A plan of treatment usually lists recommended procedures for control of current disease as well as preventive measures designed to limit recurrence or prognosis of the disease process over time.

Prognosis

Prognosis is the prediction of the duration, course and termination of a disease and its response to treatment.

METHOD OF DIAGNOSIS

1. History

- a. *Personal details:* Name, address, telephone number, sex, age, racial or

ethnic group, occupation, marital status, habits.

- b. History of present complaint
- c. Past medical history
- d. Drug history
- e. Family history
- f. Past dental history
- g. Social history

2. Clinical examination

- Inspection
- Palpation-extraorally and intraorally
- Percussion
- Auscultation

3. Provisional or presumptive diagnosis

4. Special methods of examination, including:

- Radiographic examination
- Hematological examination
- Biochemical examination
- Histological examination
- Bacteriological examination
- Special tests.

5. Definitive Diagnosis.

IMPORTANCE OF CASE HISTORY

- a. For making correct diagnosis and treatment plan.
- b. Assessment of patient's mental and behavioral status.
- c. Awareness of any systemic diseases.
- d. To know the exact nature of medication patient is taking
- e. For research purposes

- f. Expression of interest, warmth and compassion by clinician, encourages patient to communicate their concerns.

COMPONENTS OF PATIENT'S HISTORY

For the recording of patient's history we can use—history questionnaire, computerized data gathering technique, open-ended interviewing, problem-oriented recording (POR) or condition diagrams (CD).

I. Routine Information

1. **Name-** It is important to know the patient by name for patients communication and ease of the patient.
2. **Age-** Certain diseases are particular to that particular age.

Some diseases present at/since birth:

- Facial hemi-hypertrophy
- Macroglossia
- Cleft palate
- Double lip
- Cleft lip, palate and tongue
- Fibromatosis gingivae
- Fordyce's granules
- Median rhomboid glossitis
- Developmental lingual salivary gland depression
- Teratoma
- Erythroblastosis fetalis
- Hemophilia
- Tetralogy of fallot
- Bronchiolitis

Some diseases frequently seen in children and young adults:

- Focal epithelial hyperplasia
- Benign migratory glossitis
- Papillon- Lefvre syndrome
- Juvenile periodontitis
- Osteoid osteoma of the jaw
- Torus palatinus
- Kaposi's sarcoma

- Ewing's sarcoma
- Osteosarcoma of the jaw
- Burkitt's lymphoma
- Hodgkin's lymphoma
- Benign cementoblastoma
- Basal cell carcinoma
- Squamous cell carcinoma
- Scarlet fever
- Diphtheria
- Rickets
- Sickle cell anemia
- Infectious mononucleosis
- Pemphigus
- Noma
- Primary aphthous stomatitis
- Recurrent aphthous stomatitis
- Dental caries
- Nursing bottle caries (children)
- Pulp polyp
- Eruption cyst
- Dentigerous cyst (2nd decade)
- Rheumatoid heart diseases
- Juvenile diabetes

Some diseases frequently seen in adults and older patients:

- Attrition
- Abrasion
- Gingival recession
- Periodontitis
- Acute necrotizing ulcerative gingivitis
- Root resorption
- Lichen planus
- Leukoplakia
- Erythroplakia
- Sjögren's syndrome (over 40 years)
- Acinic cell carcinoma
- Necrotising sialometaplasia
- Ameloblastoma (30-50 years)
- Trigeminal neuralgia
- Glossopharyngeal neuralgia
- Fibroma
- Herpes zoster
- Osteomalacia

- Torus mandibularis
- Fibrosarcoma of jaw bone
- Diabetes
- Peptic ulcer

Child Dose Formulas

a. Young formula = $\frac{\text{child's age}}{\text{Age} + 12} \times \text{adult dose}$

b. Clark's formula = $\frac{\text{Child age at next birthday}}{24} \times \text{adult dose}$

c. Dilling's formula = $\frac{\text{Age}}{20} \times \text{adult dose}$

3. Sex: Certain diseases effecting sexual organs will be particular to the sex concerned.

Some diseases more common in females:

- Iron deficiency anemia
- Caries
- Diseases of thyroid
- Pleomorphic adenoma
- Sjögren's syndrome
- Myasthenia gravis
- Torus palatinus
- Juvenile periodontitis
- Cicatrical pemphigoid
- Recurrent aphthous stomatitis
- Malignant melanoma

Some diseases more common in males:

- Attrition
- Caries in deciduous teeth
- Carcinoma in situ
- Carcinoma of the buccal mucosa
- Leukoplakia
- Basal cell carcinoma
- Hodgkin's disease
- Ameloblastic fibro-odontoma
- Basal cell adenoma
- Pernicious anemia

4. Address: It is helpful to communicate with the patient. Few diseases are distributed to particular areas;

For example:

- i. Filariasis in orissa
- ii. Leprosy in West Bengal
- iii. Flourosis in Raichur and Nalgonda district.
 - It also helps the clinician for further correspondence

5. Occupation: It helps in diagnosing certain diseases related to the occupation.

For example:

- i. Varicos vein in bus conductors and traffic police due to long time standing.
- ii. Attrition of teeth in cobblers and tailors
- iii. Erosion is seen in people working in chemical industries.

II. Chief Complaint of the Patient

Chief complaint is recorded in patients own words and should not be translated into technical language unless reported in that fashion by the patient.

Most common chief complaint and their causes are:

i. *Pain*

- Pulpal disease
- Gingival and periodontal disease
- Salivary gland infection
- TMJ disorder
- Maxillary sinus diseases
- Tonsillar disease

ii. *Burning sensation*

- Psychosis
- Viral infection
- Fungal infection
- Xerostomic condition
- Fissured tongue
- Anemia
- Vitamin deficiency

iii. *Bleeding*

- Gingivitis
- Periodontal disease
- Allergy
- Traumatic injury
- Deficiency of coagulation factors

iv. *Loose teeth*

- Loss of supporting bone and resorption of root
- Periodontal disease
- Trauma
- Malignant tumor
- Myxoma
- Hemangioma
- Papillon-Lefevre syndrome.

v. *Recent occlusal problems*

- Periodontal disease
- Traumatic injury
- Cyst and tumor of tooth bearing region of jaw
- Fibrous dysplasia

vi. *Delayed tooth eruption*

- Malposed or impacted teeth
- Cyst
- Tumor
- Cleidocranial dysplasia
- Hypothyroidism

vii. *Xerostomia*

- Local inflammation
- Dehydration state
- Drugs like tranquilizers and antihistamines
- Autoimmune disease like Sjögren's syndrome and Mikulicz's disease
- Post radiation changes
- Psychosis

viii. *Swelling*

- Inflammation and infection
- Retention phenomenon
- Inflammatory hyperplasia
- Benign tumor
- Malignant tumor

ix. *Bad taste*

- Heavy smoking
- Poor oral hygiene
- Dental caries
- Periodontal disease
- ANUG
- Diabetes
- Medication
- Psychosis

- Decreased salivary flow

- Intraoral malignancy

x. *Paresthesia and anesthesia*

- Injury to regional nerve- anesthetic needle and jaw bone fracture
- Malignancy
- Medications like those used in sedation, hypnosis
- Pernicious anemia
- Acute infection of jaw bones.

xi. *Halitosis*

- Poor oral hygiene
- Periodontal disease
- Third molar opercula
- Decayed tooth
- ANUG
- Oral cancer
- Spicy foods
- Tobacco use
- Nasal infection
- Tonsillitis
- Gastric problems
- Diabetes

III. History of Present Illness

Patient may or may not volunteer a detail history of the problem for which they are taking treatment for and additional information usually needs to be elicited by the examiner. The patient's response to these questions constitutes the history of present illness.

These include the mode of onset, symptoms in the exact order to which aggravating and relieving factors are used.

IV. Past Dental History

It is the component of the patient's history that is particularly pertinent in the education of the dental patient significant items that should be recorded are:

- a. The frequency of past treatment, previous restorative, periodontic, endodontic or oral surgical treatment.

- b. Reasons for loss of teeth towards complication of dental treatment.
- c. Attitude towards previous dental treatment.
- d. Experience with orthodontic appliance and dental prosthesis.
- e. Fluoride history including supplement and the use of well water
- f. Radiation or other treatment for facial or oral lesion.

V. Past Medical History

It includes information about any significant or serious illness a patient may have or had as a child or as an adult and is organized into following subdivisions:

- i. *Serious or significance illness*
 - Patient is or was routinely medicated
 - Heart, liver, kidney or lung disease
 - Allergic reactions, infectious disease
 - Immunological disorder or steroid therapy
 - Diabetes or hormonal problem
 - Radiation or cancer chemotherapy or immunosuppression.
 - Psychiatric treatment
 - History of spontaneous bleeding associated with extract period
 - Therapeutic radiation to head and neck
 - Seizure disorders
 - Heart murmurs, rheumatic fever or congenital heart disease
 - Neuropathy associated with a regional oral surgery.
- ii. *Hospitalization*: A record of hospital admission, complements the information collected on serious illness and may reveal significant events not previously reported.
- iii. *Blood transfusion*: It is important in evaluating medical strains and to prevent transmissible infectious diseases.
- iv. *Allergies*: History of allergies and reactions such as urticaria, hay fever, asthma, untoward reactions to medication, food and diagnostic procedures.

- v. *Medication*: A medication history is essential for identifying drug induced disease and avoiding untoward drug administration, when selecting local anesthetic or other medications indicated in dental treatment.
- vi. *Pregnancy*: A negative urine or serum pregnancy test is required in suspected cases before administration of drug. It helps us to prescribe a medication or procedure involving exposure to ionizing radiation or drugs with known or unknown teratogenic potential.

VI. Family History

It gives information about disease that commonly effect more than 1 member of family such as migraine, some neurological and mental disorder, certain allergic disorder and cardiovascular diseases.

Inherited anatomic anomalies such as congenitally missing lateral incisors, amelogenesis imperfecta can also be diagnosed by family history recording.

VII. Social and Occupational History (personal history)

It provides important background information to a patients problem as well as suggests possible etiologies related to the social activities, the workplace or travel.

These include:

- a. Habits including smoking, drinking, which causes oral mucosal and periodontal changes.
- b. Diet – Vegetarian or non-vegetarian
- c. Menstrual history and number of pregnancies, miscarriages, whether deliveries are normal or not, in a women.

VIII. General Examination

- 1. *Built*: A clinical diagnosis may be achieved from a look on the built of the patient, it is significant in endocrine abnormalities.

2. **Gait:** This indicates the way the patient walks. Abnormal gait occurs due to
 - a. Bone and joint abnormalities
 - b. Muscle and neurologic disorder
 - c. Structural abnormality
 - d. Psychiatric disease.

Types of Gait:

- a. Waddling
 - b. Equinus
 - c. Scissor
 - d. Hemiplegic
 - e. Steppage
 - f. Shuffling
 - g. Wobbly
 - h. Staggering
 - i. Ataxic gaits.
3. **Nourishment:** Affects the built of a person.
 4. **Pallor:** It is the paleness of skin and mucous membrane either as a result of diminished circulating red blood cells or diminished blood supply. Pallor is detected in the palpebral part of the conjunctiva, skin and mucous membrane.

Causes

1. Anemia
2. Shock
3. Peripheral vascular diseases.

Sites where anemia is detected:

- Lower palpebral conjunctiva
 - Tongue
 - Soft palate
 - Palm and nails
5. **Icterus:** Icterus is a condition which is seen in jaundice and is characterized by yellow discolouration of tissues and body fluids due to an increase in bile pigments. It may arise due to:
 - Increased bile pigment load to the liver
 - Affection of bilirubin diffusion into the liver cells
 - Defective conjugation
 - Defective excretion

Icterus is detected in the bulbar part of the conjunctiva, nail, skin and oral cavity.

6. **Cyanosis:** It is a bluish discolouration of the skin and mucous membrane due to increased reduced hemoglobin more than 5 gm percent.

Types of cyanosis:

1. Central – caused due to defect in lung and heart
2. Peripheral – caused due to block in circulation in tissue
3. Mixed – seen in congestive cardiac failure
4. Differential

Difference in central and peripheral cyanosis:

Central cyanosis	Peripheral cyanosis
a. Extremities are warm	a. Extremities are cold
b. No change on warming extremities	b. Warming the extremities cyanosis disappear
c. By giving oxygen central cyanosis disappear	c. No change on giving oxygen
d. Seen in tip of nose and tongue	d. Not seen in this region
Examples:	Examples:
• Fallot's tetralogy	• Mitral stenosis
• C.C.F	• C.C.F
• A.V fistula	• Shock
• Cirrhosis	• Raynaud's disease
• Methemoglobinemia	• Cold exposure
• Sulphemoglobinemia	
• Brochitis (chronic)	

7. **Clubbing:** It is the bulbous swelling of the tip of the finger and toe.

Causes:

- i. **Respiratory cause**
 - Bronchitis
 - Bronchogenic carcinoma
 - Lung abscess
 - Interstitial lung disease
 - Empyema
- ii. **GIT/Abdominal cause**
 - Ulcerative colitis
 - Malabsorption syndrome
 - Biliary cirrhosis
 - Crohn's disease
- iii. **Cardiovascular cause**
 - Infective endocarditis
 - Cyanotic congenital heart disease

iv. *Endocranial cause*

- Myxoedema
- Thyrotoxicosis
- Acromegaly

Grading of Clubbing

Grade I – Softening of nail bed with obliteration of angle of nail bed

Grade II – Increase in anteroposterior curvature

Grade III – Increase anteroposterior and transverse curvature

Grade IV – Hypertrophic osteoarthropathy

8. *Edema*: Edema is the collection of fluid in the interstitial spaces or serous cavities. It becomes evident only when 5-6 litres of fluid have accumulated in the water depots. Pitting on pressure occurs when the circumference of the limb is increased by 10 percent.

Types:

- i. Nonpitting edema in myxedema and filariasis
- ii. Pitting edema in cardiac, liver, hypoproteinemia and renal disturbances.

9. *Ecchymosis and petechiae*: These are hemorrhagic abnormalities of the skin. Ecchymosis is an hemorrhages more than 5 cm in diameter, whereas petechiae are tiny hemorrhage less than 1mm in diameter.

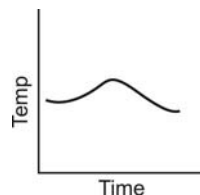
10. *Pulse*:

- The normal pulse rate is 70-100/min
- When it is increased more than 100/min then it is termed as tachycardia
- Which it is decreased and less than 60/min than it is termed as bradycardia

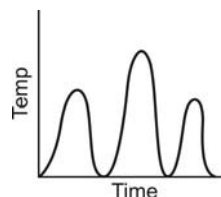
11. *Temperature*: The normal temperature is 98.4°F less than 94°F is termed as hypothermic whereas as more than 106°F is termed as hyperthermic or heat stroke.

Types of Fever

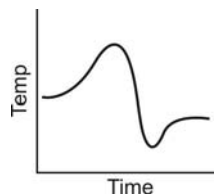
- *Continuous*- fluctuates less than 1°C; does not touch base line.



- *Intermittant*- goes up and touches line.



- *Remittant*- fluctuates more than 1°C and does not touch base line



- *Pel Ebstein type*- there is a regular alteration of recurrent bouts of fever and afebrile periods.

- *Step ladder type*- seen in typhoid.

12. *Respiratory Rate*: The normal respiratory rate is 18-20/min. when it is less than 14/min then it is termed as bradypnea whereas when it is more than 20/min then it is termed as tachypnea

13. *Blood pressure*: Blood pressure is the lateral pressure exerted by the contained column of blood on the wall of arteries. The normal blood pressure is 120 (systolic)/80 (diastolic) (mm of Hg).

JNC classification of blood pressure:

- i. Normal (less than 120/80 mm of Hg)
- ii. Prehypertensive state – (systolic 120-139/ diastolic 80-89 mm of Hg)
- iii. Stage I hypertensive – (systolic 140-159/ diastolic 90-99 mm of Hg)
- iv. Stage II hypertensive – (systolic more than 180/diastolic more than 100 mm of Hg).

IX. LOCAL EXAMINATION

A. Extraoral Examination

1. *Lymph nodes*: Lymph nodes are aggregation of lymphatic tissues present all over the body which helps in drainage.

The lymph nodes that are examined are the cervical group of lymph nodes (Fig. 2.1), which includes:

- Submandibular
- Submental
- Jugulodigastric
- Preauricular
- Postauricular
- Supraclavicular

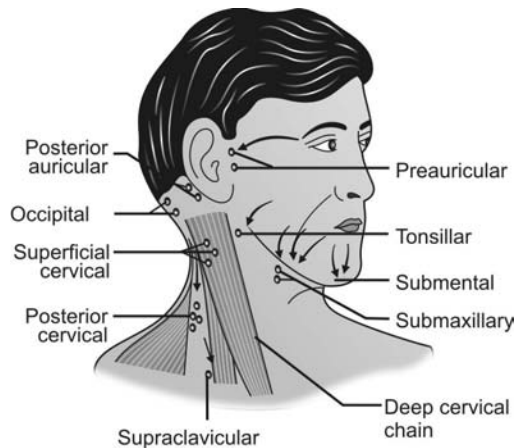


Fig. 2.1: Location of the lymph nodes of head and neck region

Types of lymph node inflammation:

- i. *Non-significant* – Where only 1 lymph node is involved, it is non tender and discrete.
- ii. *Significant* – Where more than 1 cm size increase is present and lymph node is tender and fixed.

- Palpating lymph nodes and probable associated conditions:
 - a. Tender, mobile, enlarged – Acute infection
 - b. Non-tender, mobile, enlarged – chronic infection.
 - c. Matted, non tender – tuberculosis
 - d. Fixed, enlarged – squamous cell carcinoma
 - e. Rubbery, enlarged – lymphomas.
- 2. *Temporomandibular joint*: For temporomandibular joint abnormalities we need to observe for deviation of mandible during opening and closing as well as during vertical and lateral movements, tenderness on palpation and presence of any clicking/popping sound.

B. Intraoral Examination

1. Soft Tissue Examination

- i. *Lips*: Note the colour of the lip, texture, and any surface abnormalities, angular or vertical fissures, lip pits, cold sores, ulcers, scabs, nodules, sclerotic plaque and scars.
- ii. *Labial mucosa*: Orifice of minor salivary glands and granules.
- iii. *Buccal mucosa*: Note any change in pigmentation and movability of mucosa, pronounced linea alba, leukoedema, intraoral swellings, ulcers, nodules, scars, other red and white patches and fordyces granules.
- iv. *Maxillary and mandibular mucobuccal fold*: Observe color, texture, any swelling, fistula, palpate for swelling and tenderness over the roots of teeth and tenderness of buccinator insertion.
- v. *Palate (hard and soft)*: Inspect for discoloration, swelling, fistula, papillary hyperplasia, tori, ulcers, hyperkeratinisation, asymmetry of structure, function and orifice of minor salivary glands.

- vi. *Floor of mouth*: Observe for the opening of Wharton's duct and other abnormalities.
- vii. *Tongue*: Dorsum of the tongue should be observed for any swelling, ulcer, and variations in colour, size and texture.
- viii. *Gingiva*: Observe for the colour, contour, consistency, shape, size, surface texture, position, bleeding on probing and exudation on pressure.
- ix. *Oropharynx*: Observe for the tonsils and pharynx and note for colour, size and surface abnormalities.
- x. *Saliva*: Check for the quantity and quality of saliva.

2. Hard Tissue Examination

- i. Teeth present
- ii. Teeth missing
- iii. Mobility
 - grade I
 - grade II
 - grade III
- iv. Dental caries
- v. Restored teeth
- vi. Retained teeth
- vii. Discoloured teeth
- viii. Calculus/stain
- ix. Occlusion
- x. Any other abnormalities.

PROVISIONAL DIAGNOSIS

It is the art of using scientific knowledge to identify oral disease, process and to distinguish one disease from the other.

DIFFERENTIAL DIAGNOSIS

It is the process of identifying condition by differentiating it from all pathological process that produce similar lesion.

INVESTIGATIONS

To confirm the diagnosis, a series of investigations are carried out. They are:

1. Hematological investigations
2. Urine analysis
3. Biochemical investigations
4. Radiological investigations
5. Histopathological investigations
6. Microbiological investigations

1. Hematological Investigations

Normal value

- i. Hemoglobin (Hb) = 12-14 gm percent (females)
14-18 gm percent (males)
- ii. Total RBC = 4.5-5 million (females)
5-6 million (males)
- iii. Total WBC = 4,000-11,000/cu mm.
- iv. Total platelet = 1.5 lakhs/cu mm.
- v. (DLC) Differential leukocyte count = Neutrophil – 50-70 percent
Lymphocyte – 25-40 percent
Monocytes – 3-8 percent
Eosinophil – 1-8 percent
Basophil-0-1 percent
- vi. Bleeding time(BT) = 3-5 minutes
- vii. Clotting time(CT) = 4-10 minutes
- viii. Random Blood glucose (RBG) = 80-150 mg percent
- ix. Fasting Blood glucose (FBG) = 60-100 mg percent
- x. Post prandial blood glucose (PPBS) = 100-180 mg percent

- xi. Blood urea = 10-20 mg percent
- xii. Prothrombin time (PT) = 11-15 sec
- xiii. Erythrocyte sedimentation rate (ESR) = 0-20 minutes /hr (females) (by Wintrobe method) 0-10 minutes/hr (males)
- xiv. Partial thromboplastin time (PTT) = 25-45 seconds

2. Urine Analysis

- i. Colour = light yellow, early morning urine is dark
- ii. Volume = 1000-1500 ml/day
- iii. Odour = light aromatic odour, on standing, odour becomes stronger due to bacterial decomposition
- iv. Reaction = Slightly acidic ($p^H = 4.5 - 6$)
- v. Specific gravity = 1.010 - 1.025
- vi. Urine glucose = absent
- vii. Urine blood = absent
- viii. Urine ketone, bile, bilirubin, bacteria = absent
- ix. Urine protein = 35 mg per day
- x. Urine epithelial cells, hyaline cells = occasional

3. Biochemical Investigations

- i. Serum Creatinine = 0.7-1.4 mg percent
- ii. Serum Uric acid = 2.5-8 mg percent
- iii. Serum alkaline phosphatase = 3-13 KA unit
- iv. Serum acid phosphatase = 0.6-3 KA unit

- v. Serum billirubin = 0.2-1 mg percent
- vi. Serum protein = 6-8 gm percent
- vii. SGOT = 8-40 unit/ml
- viii. SGPT = 5-35 unit/ml
- ix. Serum calcium = 9-11 mg percent
- x. Serum cholesterol = 150-250 mg percent
- xi. Serum triglyceride = 10-190 mg percent
- xii. Serum HDL = 30-75 mg percent
- xiii. Serum LDL = 80-210 mg percent
- xiv. Serum VL DL = 5-40 mg percent
- xv. Serum sodium = 135-145 m Eq/L
- xvi. Serum potassium = 3.2-5.5 m Eq/L
- xvii. Serum chloride = 95-105 m Eq/L

4. Radiological Investigations

- i. Intraoral radiographic techniques
 - a. Intraoral periapical radiographs (IOPAR)
 - b. Occlusal radiographs
 - c. Bitewing radiographs
- ii. Extraoral radiographic techniques
 - a. Postero-anterior projection
 - b. Lateral skull projection
 - c. Water's/occipitontental projection
 - d. Reverse townes projection
 - e. Submentovertex projection
 - f. Mandibular projection
- iii. Specialised radiographic techniques
 - a. Orthopantomography (OPG)
 - b. Tomography
 - c. Ultrasonography
 - d. Zero radiography
 - e. Stereoscopy
 - f. Scanography
 - g. Digital imaging/radiovisiography
 - h. Digital subtraction radiography
 - i. Nuclear medicine
 - j. Magnetic resonance imaging (MRI)
 - k. Thermography
 - l. Cine radiography
 - m. Sialography

Structure to be viewed or investigated	Radiographic technique or projection used
1. Maxillary sinus	• Water's view • Standard occlusal posterior maxillary – cross sectional projection
2. All other sinus	• Water's or paranasal sinus view
3. Mandibular fracture	
i. condyle	• Reverse towne's projection
ii. angle	• Mandibular lateral oblique projection (body and ramus)
iii. body	• Mandibular lateral oblique projection (body)
iv. canine region	• Mandibular lateral oblique projection (body)
v. ramus	• Mandibular lateral oblique projection (ramus)
vi. coronoid	• Mandibular lateral oblique projection (ramus)
4. Zygomatic fracture	• Water's view • Water's view • Submentovertex projection
5. Tempromandibular joint	• Transcranial view • Transorbital view • Transpharyngeal view • Reverse towne's view
6. Parotid gland	• Intra oral view of cheek • Mandibular lateral oblique projection (ramus)
7. Submandibular gland	• Mandibular lateral oblique projection (body) • Anterior mandibular occlusal projection

5. Histological Investigation

This is the examination of the cells and tissues collected from the diseased area for the specific pathology.

The specimen is collected by biopsy procedure and send for laboratory examinations for the report.

Biopsy: It is the study of tissue removed from a living organism to confirm the diagnosis through histopathological study.

Indications:-

1. Diagnosis of any carcinoma
2. To determine the histological nature of any soft tissue or intra mucous lesion

3. Screening of normal tissues from abnormal tissues
4. Diagnosis of malignant and non-malignant lesion.

Uses:

1. Diagnosis of pathology
2. Grading of tumor
3. Determining neoplastic and non-neoplastic features
4. Evaluation of recurrence
5. Determining the prognosis

Complication:

1. Hemorrhage
2. Infection
3. Poor wound healing
4. Spread to adjacent organs

Types:

1. Commonly used
 - Incisional
 - Excisional
 - Punch
 - FNAC
 - Aspiration
 - Curettage
 - Scrape
2. Less commonly used
 - Brush
 - Cone
 - Bite
 - Endoscopic
 - Irrigation
 - Pressure
 - Shave
 - Sponge

Excisional biopsy: It is a therapeutic as well as diagnostic procedure (Fig. 2.2).

Indication:

- Lesions smaller than 1 cm in diameter
- Freely movable lesion

Procedure:

- Local anesthesia given to area
- Excise complete lesion with 2 mm normal tissue boundary

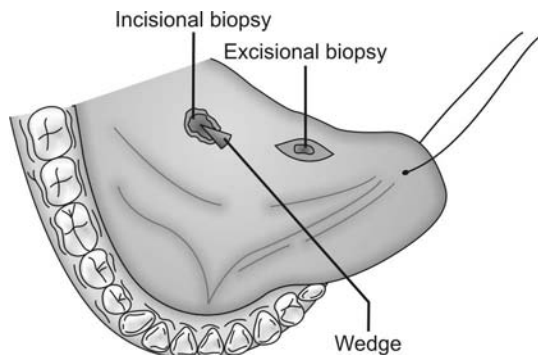


Fig. 2.2: Excisional and incisional biopsy

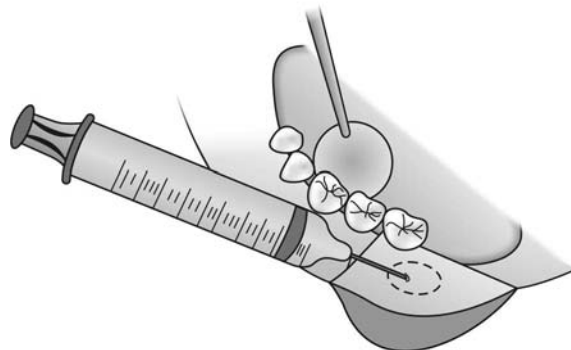


Fig. 2.3: FNAC technique

- Fix tissue in 10 percent formalin solution and send to laboratory in transport media
- Close surgical site with suturing and proper pack.

Incisional biopsy:

Indication:

Large deep and extremely deep lesions (Fig. 2.2)

Procedure:

- Local anesthesia given to area
- 'V' shaped incision is made and tissue is removed along with normal tissue boundary.
- Fix tissue in 10 percent formalin solution and send to laboratory in transport media.
- Close surgical site with suturing and proper pack.

Punch biopsy:

Indication: Rarely needed in oral cavity as most of the lesions are easily accessible. It is done in areas where lesion is small and inaccessible.

Procedure:

- Shallow hollow tube is rotated until underlying bone or muscle is reached.
- Tissue is removed and site is secured similar to that of incisional and excisional biopsy.

Brush biopsy:

- Most advanced technique for oral mucosa biopsy
- Disposable brush is used to collect transepithelial sample of cells.

Fine needle aspiration cytology (FNAC): This is a procedure where a 18-gauge fine needle is inserted into the lesion and the tissue content is aspirated, which is thereby send to the laboratory for examination. It is a very useful procedure for diagnosing cystic lesions and differentiating benign lesion from malignant lesion (Fig. 2.3).

Transport media: After obtaining the tissue specimen it should be kept in a fixative solution for fixation. This prevents the autolysis of protein content of the tissues thus prevents the breakdown of protein to amino acids. 10 percent formalin (10 parts of 40% formalin + 90 parts of water) is mostly used fixative which changes the tissue protein framework, thus facilitating sectioning and strengthening the protein linkage against breakdown during the staining process.

Before fixing the tissue they should be properly washed in normal saline to remove excess blood as haematin of hemoglobin reacts with formalin, thus reducing its concentration and action.

In case where formalin is not available, local anesthetic solution can also be used. The analgesic content maintains the tonicity and sodium bisulfite present acts as a preservative.

Exfoliative cytology: It is the study of exfoliated or abraded cells and tissues.

Features:

- It is not a substitute but an adjunct to biopsy

- It is quick, simple, painless and bloodless procedure.
- It helps in checking false negative biopsy
- It is helpful for follow up examination of carcinoma
- It is mostly helpful for areas not reached by biopsy like in GIT

Procedure:

- Clean oral surface of debris and mucosa.
- Vigorously scrape the entire lesion surface, using a metal spatula or moistened tongue blade or cytobrush.
- Collected specimen is then quickly placed over slide.
- Fixing is done by fixating solution like absolute alcohol or equal quantities of alcohol and ether but never heat fixed.
- Second slide preparation using other scraping is also required.

Limitations:

- Presence or extent of invasion is not assessed.
- Most oral benign lesions do not answer to this procedure like fibroma, leukoplakia.
- Negative cytology report cannot rule out cancer but is recommended for biopsy.

Advantages:

- Other diseases having specific cells are also diagnosed like Herpes simple, herpes zoster, pernicious anaemia etc.
- The process is used for forensic odontology.

Report study:

Class I – Normal

Class II – Atypical (presence of minor atypia but no malignancy)

Class III –Intermediate (between cancer and no cancer- wide atypia suggests cancer but is not clear cut, so told to be pre-malignant). Biopsy is recommended.

Class IV - Suggestive of cancer (few malignant and few border line cells seen). Biopsy is mandatory.

Class V – Positive for cancer (malignant cells seen). Biopsy is mandatory.

6. Microbiological Investigations

These are the test for the micro-organisms- bacteria's, fungi, virus, protozoa etc.

Blood, sputum, serum and other specimen are collected and examined for microbiology. For septicemia- aerobic and anaerobic cultures should be considered.

Various special methods are available besides the routine eosin and haematoxylin smears.

These are:

- Z – N staining (Ziehl-Neelsen)
- ELISA
- PCR
- Culture methods
- PAC staining
- Immunofluorescence test
- VDRL
- Serological tests

Treatment Plan

A treatment plan is a carefully sequenced series of services designed to eliminate or control etiologic factors, repair existing damage and create a functional maintainable environment.

Treatment planning depends on:

1. Patient evaluation
2. Dentist's expertise
3. Understanding indications and contraindications
4. Predictions of patient's response after treatment.

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Management of Medically Compromised Patients and Medical Emergencies

3

INTRODUCTION

Medical emergency is an unforeseen or an unexpected circumstances requiring immediate attention. Fortunately medical emergencies are rare in dental practice but any clinician should have a thorough knowledge of the medical emergencies to overcome them if any arise.

Preparation of the clinician to handle medical emergencies are:

1. Personal containing education in emergency recognition and management.
2. Auxiliary staff education in emergency recognition and management.
3. Establishment and periodic testing of a system to readily access medical assistance when an emergency occurs.
4. Equipping office with supplies necessary for emergency care.

Management of some common medical emergencies occurring in a dental practice:

I. *Cardiac conditions:*

1. Angina pectoris
2. Congestive cardiac failure
3. Hypertension
4. Myocardial infarction

II. *Respiratory conditions:*

1. Asthma
2. COPD

III. *Hormonal conditions:*

1. Hypoglycemia
2. Adrenal suppression and insufficiency

3. Hyperthyroidism

4. Diabetes

5. Anxiety

IV. *Other conditions:*

1. Renal insufficiency
2. Hepatic insufficiency
3. Anticoagulant therapy
4. Seizure disorder
5. Hypersensitivity
6. Hyperventilation
7. Syncope
8. Shock
9. Tachyphalaxis
10. Local anesthesia toxicity
11. Foreign body aspiration
12. Hemorrhage
13. Pregnancy.

I. CARDIAC CONDITIONS

Features Confirming Cardiac Disorder

- Chest discomfort on exertion, when eating or at rest.
- Palpitation
- Fainting
- Ankle edema
- Dyspnea on exertion and on assuming supine position
- Postural hypotension
- Fatigue
- Leg muscle cramping

Management of Patient with Angina Pectoris

1. Consult patients physician
2. Use anxiety reduction protocol.
3. Have nitroglycerin tablets or spray readily available (use premedication if needed).
4. Administer supplemental oxygen.
5. Ensure profound local anesthesia before starting surgery
6. Consider use of nitrous oxide sedation
7. Monitor vital signs closely
8. Possible limitation of amount of adrenaline to 0.04 mg maximum (4 ml of LA with 1: 1,00,000 adrenaline)
9. Maintain verbal contact with patient throughout procedure to monitor status.

Management of Patient with Congestive Cardiac Failure

1. Defer treatment until heart function has been medically improved and physician believes treatment is possible.
2. Use anxiety reduction protocol.
3. Possible administration supplemental oxygen
4. Avoid supine position
5. Consider referral to oral and maxillofacial surgeon
6. An upright patient position is preferred during treatment.

Management of Patient with Hypertension

Mild to moderate hypertension (BP more than 140/90 mm of Hg)

1. Recommend that the patient seeks the primary care physician guidance for medical therapy of hypertension.
2. Monitor the patients blood pressure at each visit and whenever administration of adrenaline- containing local anesthesia surpasses 0.04 mg during a single visit.

3. Use an anxiety reduction protocol.
4. Avoid rapid posture changes in patients taking drugs that cause vasodilatation.
5. Avoid administration of sodium- containing intravenous (I.V) solutions.

Severe hypertension:- (BP more than 200/110 mm of Hg)

1. Defer elective dental treatment until hypertension is better controlled.
2. Consider referral to oral and maxillofacial surgeon for emergency problems.

Management of Patient with Myocardial Infarction

1. Same as managing a patient with Angina.
2. Defer surgery if possible for 6 months post MI attack.
3. Administer oxygen.
4. Check if patient is taking anticoagulants.

II. RESPIRATORY CONDITIONS

Features confirming respiratory disorders:-

- Perspiration
- Tachycardia
- Wheezing (audible with or without stethoscope)
- Coughing
- Excessive sputum production
- Hemoptysis (coughing blood)
- Dyspnea with exertion.

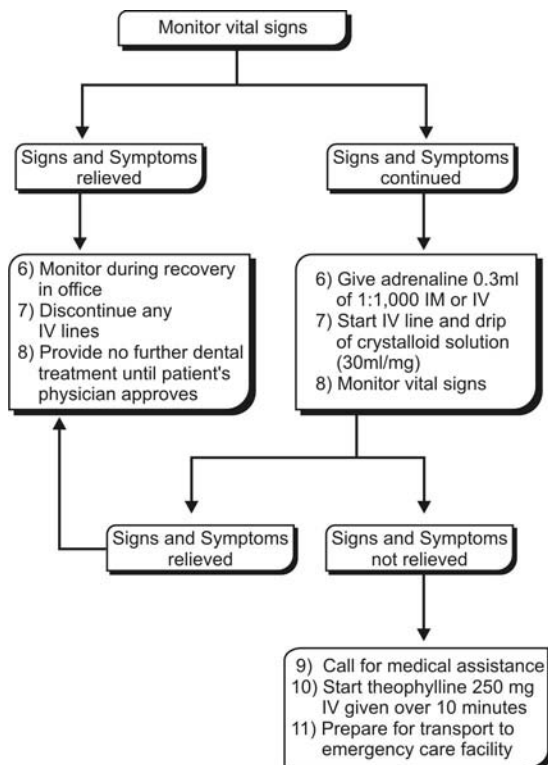
Management of Patient with Asthma

1. Defer dental treatment until asthma is well controlled and patient has no signs of a respiratory tract infection.
2. Listen to chest with stethoscope to detect wheezing before major oral surgical procedures or sedation.
3. Use anxiety reduction protocol, including nitrous oxide, but avoid use of respiratory depressants.

4. Consult physician about possible use of preoperative cromolyn sodium.
5. If patient is or has been chronically on corticosteroids, prophylax for adrenal insufficiency.
6. Keep a bronchodilator – containing inhaler easily accessible.
7. Avoid use of nonsteroidal anti inflammatory drugs (NASIDs) in susceptible patients.
8. Afternoon or midday appointments are preferred.

Management of Patient with Acute Asthmatic Episode Occurring during Dental Sugery

1. Terminate all dental procedures
2. Position patient in fully sitting posture
3. Administer bronchodilator by spray
4. Administer oxygen
- 5.



Management of a Patient with Chronic Obstructive Pulmonary Disease (COPD)

1. Defer treatment until lung function has improved and treatment is possible.
2. Listen to chest bilaterally with stethoscope to determine adequacy of breath sounds.
3. Use anxiety reduction protocol, but avoid use of respiratory depressants.
4. If patient is on chronic oxygen supplementation, continue at prescribed flow rate. If patient is not on supplement oxygen therapy, consult physician before administering oxygen.
5. If patient chronically receives corticosteroid therapy, manage patient for adrenal insufficiency.
6. Avoid placing patient in supine position until confident that patient can tolerate it.
7. Keep a bronchodilator- containing inhaler accessible.
8. Closely monitor respiratory and heart rates.
9. Schedule afternoon appointments to allow for clearing of secretions.

III. HORMONAL CONDITIONS

Features Confirming Acute Hypoglycemia

Mild Hypoglycemia

- Hunger
- Nausea
- Mood changes
- Weakness

Moderate Hypoglycemia

- Tachycardia
- Perspiration
- Pallor
- Anxiety
- Behavior change:
 - Belligerence
 - Confusion
 - Uncooperativeness.

Severe Hypoglycemia

- Hypotension
- Unconsciousness
- Seizures.

Management of Patient Suffering from Acute Hypoglycemia

1. Terminate all dental treatment

For Mild Hypoglycemia:

2. Administer glucose source such as sugar or fruit by mouth.
3. Monitor vital signs.
4. Before further dental care, consult physician, if unsure whether or why hypoglycemia has occurred.

For Moderate Hypoglycemia:

2. Orally administer glucose source, such as sugar or fruit juice
3. Monitor vital signs.
4. If symptoms do not rapidly improve, administer 50 ml 50 percent glucose or 1 mg glucagon intravenously (I.V) or intramuscularly (I.M).
5. Consult physician before further dental care.

For Severe Hypoglycemia:

2. Administer 50 ml, 50 percent glucose IV or IM or 1mg glucagon.
3. Have someone summon medical assistance
4. Monitor vital signs
5. Administer oxygen.
6. Transport to emergency care facility.

Features Confirming Acute Adrenal Insufficiency

- Weakness
- Feeling of extreme fatigue
- Confusion
- Hypotension
- Nausea
- Abdominal pain
- Myalgias
- Partial or total loss of consciousness.

Management of Patient Suffering from Acute Adrenal Insufficiency

1. Terminate all dental treatment.
2. Position patient in supine position, with legs raised above level of head.
3. Have someone summon medical assistance.
4. Administer corticosteroid (100 mg of hydrocortisone or its equivalent) I.M or I.V
5. Administer oxygen
6. Monitor vital signs.
7. Start I.V line and drip of crystalloid solution.
8. Start basic life support, if necessary.
9. Transport to emergency care facility.

Management of Patient Suffering from Hyperthyroidism

1. Defer surgery until thyroid dysfunction is well controlled.
2. Monitor pulse and blood pressure before, during and after surgery.
3. Limit amount of epinephrine used.

Management of Patient Suffering from Diabetes

Insulin Dependent Diabetes

1. Defer surgery until diabetes is well controlled; consult physician.
2. Schedule an early morning appointment; avoid lengthy appointments.
3. Use anxiety reduction protocol, but avoid deep sedation techniques in outpatients.
4. Monitor pulse, respiration and blood pressure before, during and after surgery.
5. Maintain, verbal contact with patient during surgery
6. If patient must not eat or drink before oral surgery and will have difficulty eating after surgery, instruct patient to not take the usual dose of regular or neutral protamine hagedorn insulin; start an I.V with an D5 W drip at 150 ml/hour.

7. If allowed, have the patient eat a normal breakfast before surgery and take the usual dose of regular insulin but only half the dose of NPH insulin.
8. Advise patients not to resume normal insulin doses until they are able to return to usual level of caloric intake and activity level.
9. Consult physician if any questions concerning modifications of the insulin regimen arise.
10. Watch for signs of hypoglycemia.
11. Treat infections aggressively.

Non-insulin Dependant Diabetes

1. Defer surgery until diabetes is well controlled.
2. Schedule an early morning appointments; avoid lengthy appointments.
3. Use an anxiety reduction protocol.
4. Monitor pulse, respiration and blood pressure before, during and after surgery.
5. Maintain verbal contact with the patient during surgery.
6. If patient must not eat or drink before oral surgery and will have difficulty eating after surgery, instruct patient to skip any oral hypoglycemic medications that day.
7. If patient can eat before and after surgery, instruct patient to eat a normal breakfast and to take the usual dose of hypoglycemic agent.
8. Watch for signs of hypoglycemia.
9. Treat infections aggressively.

Management of Patients with Anxiety (Anxiety Protocol)

Before Appointment

- Hypnotic agent to promote sleep on night before surgery (optional)
- Sedative agent to decrease anxiety on morning of surgery (optional).
- Morning appointment and schedule so that reception room time is minimized.

During Appointment

Non-pharmacological means of anxiety control

- Frequent verbal reassurances
- Distracting conversation
- No surprises (clinician warns patient before doing anything that could cause anxiety).
- No unnecessary noise.
- Surgical instruments out of patient's sight.
- Relaxing background music.

Pharmacologic means of anxiety control

- Local anesthetics of sufficient intensity and duration.
- Nitrous oxide.
- Intravenous anxiolytics.

After surgery

- Succinct instructions for post operative care.
- Patient information on expected post surgical sequel.
- Further reassurance
- Effective analgesics
- Patient information on who can be contacted if any problems arise.
- Telephone call to patient at home during evening after surgery to check if any problems exist.

IV. OTHER CONDITIONS

Management of Patients with Renal Insufficiency

1. Avoid the use of drugs that depend on renal metabolism or excretion. Modify the dose if such drugs are necessary.
2. Avoid the use of nephrotoxic drugs, such as non-steroidal anti inflammatory drugs.
3. Defer dental care until the day after dialysis has been given.
4. Consult physician concerning use of prophylactic antibiotics.
5. Monitor blood pressure and heart rate.
6. Look for signs of secondary hyperparathyroidism.

7. Consider hepatitis B screening before dental treatment. Take hepatitis precautions if unable to screen for hepatitis.

Management of Patient with Hepatic Insufficiency

1. Attempt to learn the cause of the liver problem; if the cause is hepatitis B, take usual precautions.
2. Avoid drugs requiring hepatic metabolism or excretion; if there use is necessary, modify dose.
3. Screen patients with severe liver disease for bleeding disorders with platelet count, prothrombin time, partial thromboplastin time and bleeding time
4. Attempt to avoid situations in which the patient might swallow large amount of blood.

Management of Patient with Anticoagulant Therapy

Patient receiving aspirin or other platelet inhibiting drug:

1. Consult physician to determine the safety of stopping the anticoagulant drug for several days.
2. Defer surgery until the platelet inhibiting drugs have been stopped for 5 days.
3. Take extra measures during and after surgery to help promote clot formation and retention.
4. Restart drug therapy on the day after surgery if no bleeding is present.

Patients receiving Warfarin (coumarins):

1. Consult the patient's physician to determine the safety of allowing the prothrombin time to fall to 1.5 INR for a few days.
2. Obtain the baseline prothrombin time.
3. a. if the PT is 1 to 1.5 INR, proceed with surgery and skip to step 6.
b. the PT is more than 1.5 INR, go to step 4.
4. Stop warfarin approximately 2 days before surgery.
5. Check the PT daily and proceed with surgery on the day when the PT fails to 1.5 INR

6. Take some extra measures during and after surgery, to help promote clot formation and retention.
7. Restart warfarin on the day of surgery.

Patients receiving Heparin:

1. Consult the patient's physician to determine the safety of stopping heparin for the perioperative period.
2. Defer surgery until at least 6 hours after the heparin is stopped or reverse heparin with protamine.
3. Restart heparin once a good clot has formed.

Management of Patient with a Seizure Disorder

1. Defer surgery until the seizures are well controlled
2. Consider having serum levels of anti seizure medications measured if patient compliance is questionable.
3. Use anxiety reduction protocol.
4. Avoid hypoglycemia and fatigue.

Manifestation and Management of Hypersensitivity (Allergic) Reactions

Manifestations	Management
<i>Skin signs</i>	
a. Delayed onset skin signs: erythema, Pruritis, angioedema	i. Stop administration of all drugs presently in use ii. administer IV or IM Benadryl 50 mg iii. refer to physician iv. prescribe oral antihistamine, such as Benadryl 50 mg q6h
b. Immediate onset skin signs: erythema, Pruritis, urticaria	i. stop administration of all drugs presently in use ii. administer epinephrine 0.3 ml of 1: 1000 subcutaneously. iii. administer antihistaminic IM or IV. iv. monitor vital signs v. consult patient's physician vi. observe in office for one hour vii. prescribe Benadryl 50 mg q6h.

Respiratory tract signs with or without cardiovascular or skin signs

- | | |
|--|---|
| a. Wheezing, mild dyspnea | <ul style="list-style-type: none"> i. stop administration of all drugs presently in use. ii. place patient in sitting position iii. administer adrenaline iv. provide I.V access v. consult patient's physician or emergency department physician vi. observe in office for at least 1 hour vii. prescribe antihistamine |
| b. Stridorous breathing (i.e crowding sound) moderate to severe dyspnea. | <ul style="list-style-type: none"> i. stop administration of all drugs presently in use. ii. sit the patient upright and have someone summon medical assistance. iii. administer adrenaline iv. give oxygen (6 L/Min) by face mask or nasally v. monitor vital signs frequently vi. administer antihistamine vii. provide IV access; if signs worsen treat as for anaphylaxis viii. consult patient's physician or emergency room physician; prepare for transport to emergency room if signs do not improve rapidly. |
| c. Anaphylaxis (with or without skin signs): malaise, wheezing, moderate to severe dyspnea, stridor, cyanosis, total airway obstruction, nausea, and vomiting, abdominal cramps, urinary incontinence, tachycardia, hypotension, cardiac dysrhythmias, cardiac arrest. | <ul style="list-style-type: none"> i. stop administration of all drugs presently in use. ii. position patient supine on back board or on floor and have someone summon assistance. iii. administer epinephrine iv. initiate basic life support and monitor vital signs v. consider cricothyrotomy if trained in use and if laryngospasm is not quickly relieved with epinephrine. vi. provide I.V access. vii. give oxygen 6 L/Min. viii. administer antihistamine IV or IM ix. prepare for transport |

Features Confirming Hyperventilation

Neurologic:

- Dizziness
- Tingling or numbness of fingers, toes or lips
- Syncope

Respiratory:

- Increased rate and depth of breath
- Feeling of shortness of breath
- Chest pain
- Xerostomia

Cardiac:

- Palpitations
- Tachycardia

Musculoskeletal:

- Myalgia
- Muscle spasm
- Tremor
- Tetany

Psychologic:

- Extreme anxiety.

Management of Patient with Hyperventilation

1. Terminate all dental treatment and remove foreign bodies from mouth.
2. Position patient in chair in almost fully upright position
3. Attempt to verbally calm patient
4. Have patient breathe CO₂ – enriched air, such as in and out of a small bag.
5. If symptoms persist or worsen, administer diazepam, 10 mg I.M or titrate slowly I.V until anxiety is relieved, or administer midazolam 5 mg IM or titrate slowly IV until anxiety is relieved
6. Monitor vital signs
7. Perform all further dental surgery using anxiety reducing measures.

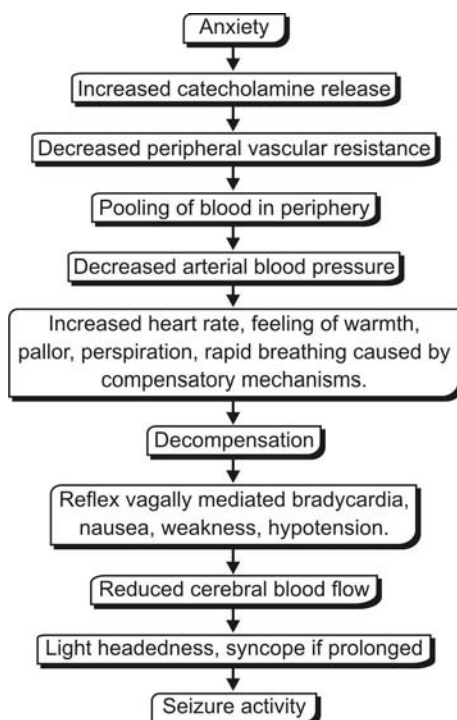
Syncope

It is transient loss of consciousness due to cerebral anoxia (reduced cerebral perfusion) thus unable to maintain posture.

Types

1. Cardiac syncope
2. Vasovagal syncope
3. Postural syncope
4. Drug induced syncope
5. Cerebrovascular syncope

Pathophysiology and Manifestation of Vasovagal Syncope



Management

1. Maintain supine position with legs lifted above head, therefore increased blood to brain.

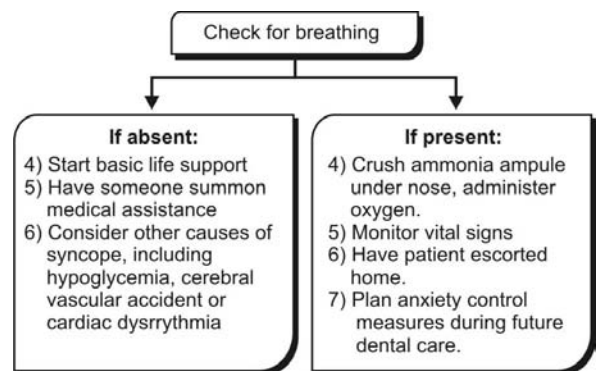
2. Loosen tight clothing.
3. Maintain airway (Remove any obstruction in path)
4. Inhalation of aromatic spirit of ammonia (helps securing reflex stimuli)
5. Oxygen administration
6. Maintain vital signs
7. If unconsciousness for longer time than treat cause.

Prodrome

1. Terminate all dental treatment
2. Position patient in supine position with legs raised above level of head.
3. Attempt to calm patient
4. Place cool towel on patient's forehead
5. Monitor vital signs

Syncopal Episode

1. Terminate all dental treatment
2. Position patient in supine position with legs raised
- 3.

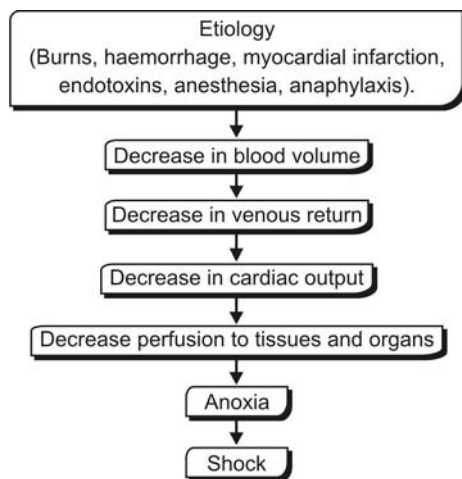


Shock

It is hemodynamic disturbance where there is systemic hypoperfusion of tissues and organs.

Pathogenesis and Classification

Type	Cause	Mechanism
1. Hypovolaemic shock	-Haemorrhage, trauma - fluid loss, burns	-Decrease in blood volume
2. Cardiogenic shock	- Myocardial infarction	-Decrease in cardiac output
3. Septic shock	-Endotoxins	-Peripheral vasodilatation -Pooling of blood in periphery
4. Neurogenic shock	-During anesthesia -Spinal cord injury	-Peripheral vasodilatation and pooling of blood in periphery
5. Anaphylactic shock	- Anaphylaxis	-Peripheral vasodilatation and pooling of blood in periphery



Features

Three stages in shock are:

- i. *Early/compensatory/non progressive stage:*
 - Tachycardia
 - Peripheral vasoconstriction
- ii. *Progressive stage:*
 - Decrease in blood pressure
 - Decrease in cardiac output
 - Tachypnea

iii. Irreversible stage –

- Decrease in blood pressure
 - Decrease in cardiac output
 - Tachypnea
 - Decrease blood to vital organ and specific features
 - Can lead to death.
- Pale lips, nails, finger, ear lobe and mucous membrane
 - Sunken eye
 - Weak pulse
 - Shallow respiration
 - Abnormal temperature.

Management

It can be easily prevented than treated:

1. Supine position with head below the feet should be positioned.
2. Oxygen inhalation
3. Maintain airway, and it may need tracheostomy.
4. Monitor vital signs
5. Maintain body heat by covering with blanket and hot packs.
6. Restore lost body fluid.
7. Treat cause and symptomatic relief should be provided.
8. Injection hydrocortisone and atropine sulphate, antibiotics, adrenaline.

Tachyphylaxis

It is the falling off in the effect produced by a drug during continuous use or constantly repeated administration.

It is mainly seen in drugs of nervous systems.

Eg:- Pain returns back before re-injection.

This occurs due to:

- Oedema
- Localized bleeding
- Clot formation
- Hypernatremia
- Decrease PH of tissues

Local Anesthesia Toxicity

Manifestations and Management of LA toxicity

Manifestation	Management
i. Mild toxicity: talkativeness, anxiety, slurred speech, confusion.	– Stop administration of local anesthetics. – Monitor all vital signs. – Observe in office for 1 hour.
ii. Moderate toxicity: stuttering speech, nystagmus, tremors, headache, dizziness, blurred vision, drowsiness	– Stop administration of local anesthetics. – Place in supine position – Monitor all vital signs. – Administer oxygen – Observe in office for 1 hour.
iii. Severe toxicity: Seizure, cardiac dysrhythmia or arrest	– Place in supine position – if seizure occurs, protect patient from nearby

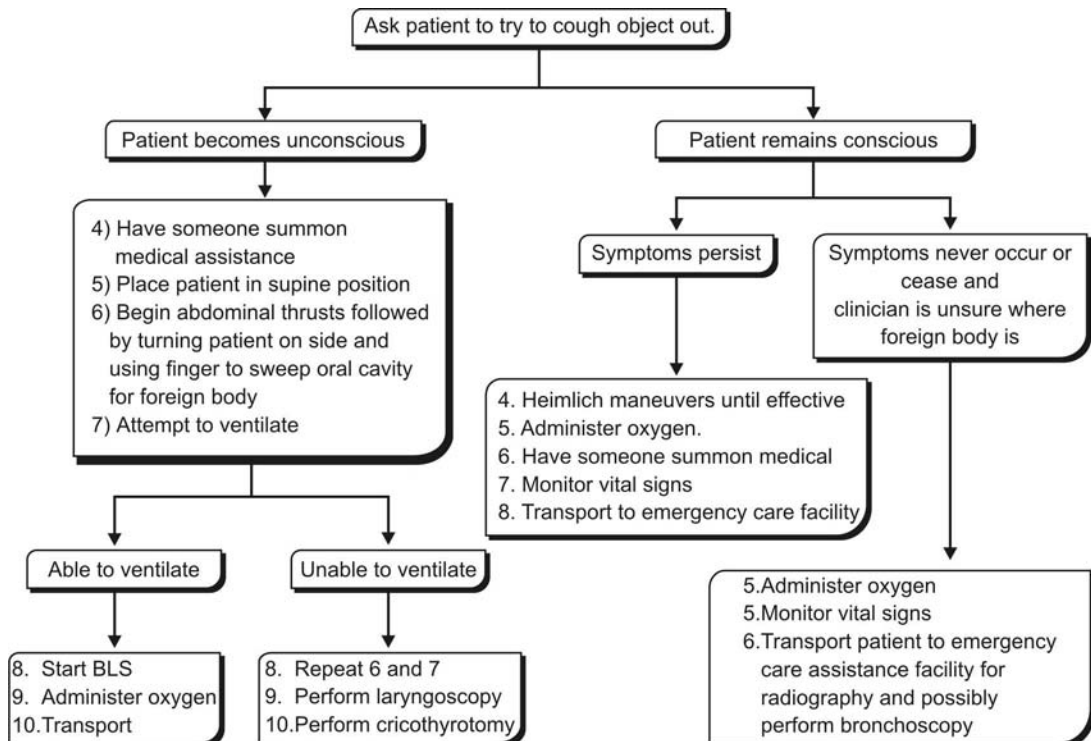
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Manifestation	Management
	- objects; suction oral cavity if vomiting occurs – have someone summon medical assistance – Monitor all vital signs – administer oxygen – start I.V – administer diazepam 5-10 mg slowly or midazolam 2-6 mg – institute basic life support if necessary. – Transport to emergency care facility.

Management of Respiratory Tract Foreign Body Aspiration in Patient Undergoing Dental Surgery

1. Terminate all dental treatment.
2. Position patient in sitting posture.
- 3.



Hemorrhage

Hemorrhage is the escape of blood from a ruptured blood vessels externally or internally. Arterial blood is bright red and emerges in spurts, venous blood in dark red and flows steadily, while damage to minor vessels may produce only an oozing. Rupture of major blood vessel can lead to the loss of several litres of blood in few minutes, resulting in shock, collapse and death if untreated.

Causes

1. In normal patients:
 - i. Intraoperative
 - Incision
 - Damage caused while using various hemostatic techniques
 - ii. Postoperative
 - primary
 - reactionary
 - secondary
2. In diseased patients:
 - Coagulation defects.
 - Thrombocytopenia
 - Capillary abnormalities
 - Transfusion defects.

Management of Intraoperative Hemorrhage

- Application of pressure on bleeding areas (Fig. 3.1)
- Elective ligation of the arteries
- Hemostats used for catching the bleeding point (Fig. 3.3).
- Application of thrombin or Russels viper venom, precipitate clot formation.
- Packing of bony cavity with gauze pack soaked in Benzoin or white head varnish

- Packing with oxidized cellulose or any absorbable hemostatic agent like gelform
- Application of hemostatic agent like Bone wax on bone bleeding point. (bone wax = 7 parts of yellow bee wax + 2 parts olive oil + 1 part phenol by weight) (Fig. 3.2)
- Cauterizing the bleeding points with chemical agent.

Postoperative Hemorrhage

Six reasons and difficulty to stop bleeding from extracted socket:

1. The tissues of mouth and jaw are highly vascular
2. Extraction leads a open wound in soft tissue and bone
3. Difficult to apply dressing material and proper pressure and sealing to the intraoral sites.
4. Patient tends to play with the surgical area, therefore dislodges clot.
5. Small negative pressure is created repeatedly therefore dislodges clot.
6. Salivary enzymes lyse clot.

Primary Hemorrhage

It is the persistence of bleeding even after the completion of surgery

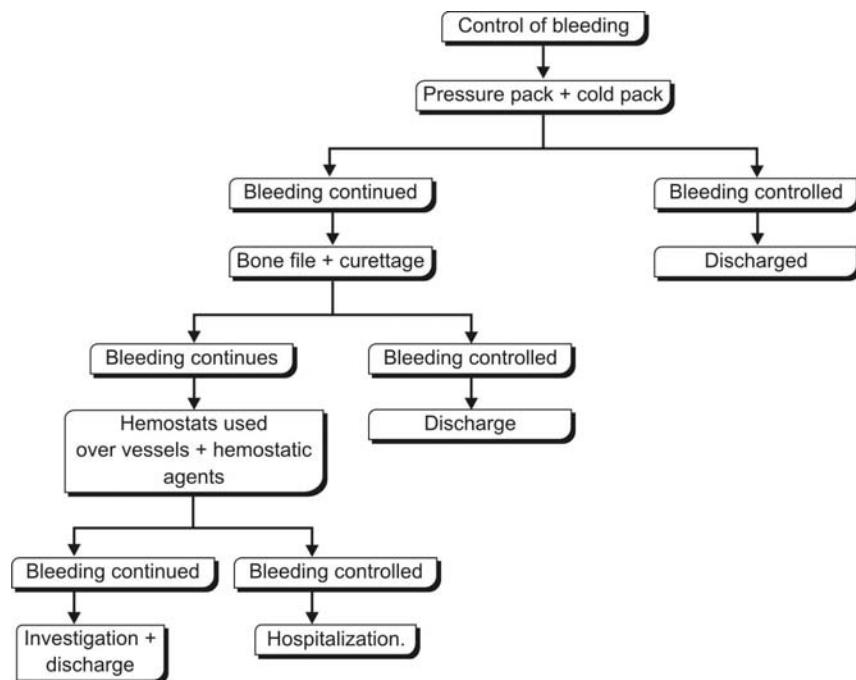
Reactionary Hemorrhage

It is the oozing of blood from surgical site after a few minutes till hours after surgery due to reactionary vasodilatation of vessels or dislodgement of clot which was still not matured.

Secondary Hemorrhage

It is the oozing of blood 4-10 days after surgical procedure. This occurs generally due to infection present in the area of surgery.

Control of Primary Hemorrhage



Control of Secondary Hemorrhage

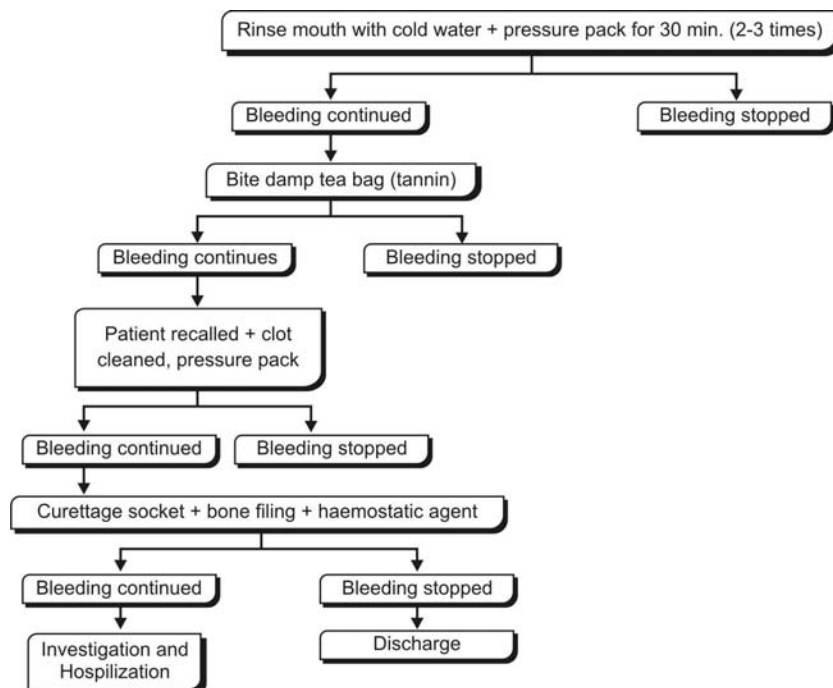




Fig. 3.1: Hemorrhage management on applying pressure

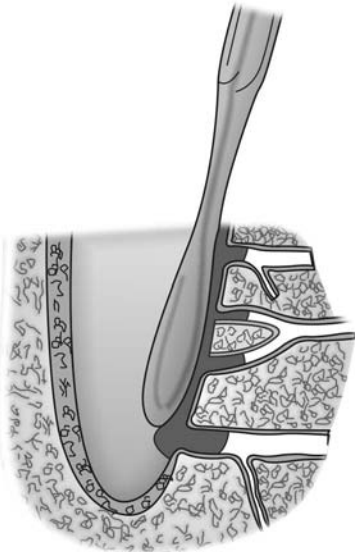


Fig. 3.2: Use of bone wax

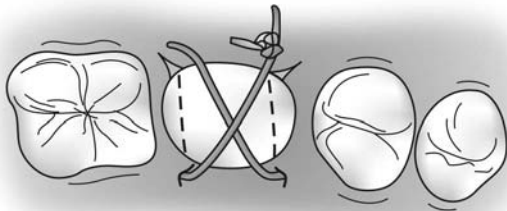


Fig. 3.3: Suturing and applying pressure on soft tissues

Management of Patient Who is Pregnant

1. Defer surgery after delivery if possible
2. Consult the patient's obstetrician if surgery cannot be delayed
3. Avoid dental radiographs unless information about tooth roots or bone is necessary for proper dental care. If radiographs must be taken, use proper shielding.
4. Avoid the use of drugs with teratogenic potential. Use local anesthetics when anesthesia is necessary.
5. Use at least 50 percent oxygen if nitrous oxide sedation is used
6. Avoid keeping the patient in the supine position for long periods, to prevent vena cava compression
7. Allow the patient to take frequent trips to the rest room.

Dental Medications to Avoid in Pregnant Patients

- Aspirin and other nonsteroidal anti-inflammatory drugs.
- Carbamazepine
- Chloral hydrate
- Chlordiazepoxide
- Corticosteroids
- Diazepam and other benzodiazepines
- Diphenhydramine hydrochloride
- Morphine
- Nitrous oxide (if exposure is greater than 9 hr/week or O₂ is less than 50%)
- Pentazocine hydrochloride
- Phenobarbital
- Promethazine hydrochloride
- Propoxyphene
- Tetracycline

CARDIOPULMONARY RESUSCITATION

Cardiopulmonary resuscitation (CPR) is a life – saving technique useful in medical emergencies, including heart attack or drowning, in which someone's breathing or heart beat has stopped.

Its main function is to re-establish cardiac and pulmonary functions in emergency cases. CPR can be administered outside hospital or in hospital. If it is done outside hospital, then cardiopulmonary resuscitation is providing basic life support, but if it is done in hospital, then basic life support (BLS) as well as advanced care life support (ACLS) is also given.

Objectives

The ABCs of life is maintained.

They are:-

A—Airway

- i. Place the patient in supine position with head higher than the legs.
- ii. Patency of the airway is checked
- iii. Any obstruction in the airway by any foreign body is removed.
- iv. Patient's airway is opened by a head tilt-chin lift position.

B—Breathing:

Administer mouth to mouth breathing (Fig. 3.4). Mouth to nose breathing or mouth to airway breathing, can also be given if mouth is seriously injured or cannot be opened.

C—Circulation:

- i. External cardiac compressions are given to restore blood circulation.

Compression Method

1. In case of 1 operator, 15 compressions with 2 ventilations are given, which is 1 cycle. 5 cycles are performed and then carotid pulse is checked. If the pulse is absent, then CPR should be resumed (Fig. 3.5).
2. In case of 2 operators, 5 compressions with 1 ventilation is administered.

Patient Evaluation

The improvement of the patient during administration of basic life support is evaluated by the colour of the skin and mucosa, chest size, pulse rate, respiratory movements, and pupil of the eyes.



Fig. 3.4: Mouth to mouth breathing

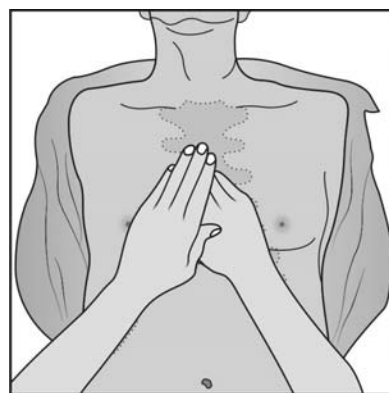


Fig. 3.5: Chest compression

THERAPEUTICS IN ORAL SURGERY

Antibiotics

These are substances produced by micro organisms that either retard the growth of or kill other micro-organisms at high dilution.

Antimicrobial Agents

These are similar to antibiotics, except that they are synthetic.

Classification of Antimicrobial Agents According to their Mechanism of Action

1. Drugs inhibiting cell wall synthesis:
 - Penicillin
 - Cephalosporins
 - Vancomycin
 - Cyclosporine
 - Bacitracin

2. Drugs inhibiting protein synthesis:
 - Drug binds to 30s ribosomal subunit:
 - Tetracycline
 - Aminoglycoside
 - Drug binds to 50s ribosomal subunit:
 - Chloramphenicol
 - Macrolides
3. Drugs affecting cell permeability
 - Aminoglycoside
4. Drugs affecting DNA Gyrase:
 - Quinolones
5. Drugs interfering with DNA function:
 - Rifampicin
 - Metronidazole
6. Drugs interfering with DNA synthesis:
 - Idoxuridine
 - Acyclovir
7. Drugs interfering with intermediate metabolism:
 - Sulfonamides
 - PAS
 - Trimethoprim
 - Pyrimethamine
 - Ethambutol

β-LACTAMASE INHIBITORS

Classification

A. Penicillin

1. Natural penicillin
 - i. Benzyl penicillin
 - ii. Sodium penicillin
 - iii. Depot penicillin (procaine pen)
2. Semisynthetic penicillin
 - i. Acid resistant penicillin
 - phenoxy ethyl penicillin
 - phenoxy methyl penicillin
 - ii. β-lactamase resistant penicillin
 - oxacillin
 - dicloxacillin
 - cloxacillin
 - iii. Broad spectrum penicillin
 - Amoxycillin
 - Ampicillin

- iv. Extended spectrum penicillin
 - Piperacillin
 - carbanicillin
 - Ticarcillin
- v. Reverse spectrum penicillin
 - Imipenem
- vi. β-lactamase inhibitor
 - Salbactam
 - Tazobactam

B. Cephalosporin

1. First generation (against gram positive cocci and gram negative aerobes – *E. Coli*, proteus)
 - i. Oral
 - cephradine
 - cephalaxin
 - cefodroxil
 - ii. Parenteral
 - cephrodine
 - cephaloxine
 - cephalothin
2. Second generation (against first generation organism and *H. influenzae*)
 - i. Oral
 - cefuroxime
 - cefaclor
 - ii. Parenteral
 - cefuroxime
 - cefatetan
 - cefoxitin
3. Third generation (*Neisseria*, *E. coli*, *H. influenzae*, *Pseudomonas*)
 - i. Oral
 - cefixime
 - cefprozoxime
 - ii. Parenteral
 - ceftriaxone
 - cefataxime
 - cefaperazone
4. Fourth generation (gram positive, gram negative, *Pseudomonas*)
 - Parenteral
 - cefipime
 - cefpirome

Mechanism of Action

Agent binds to cell membrane protein and inhibits cross linking between NAM and NAG and thus preventing cell wall formation of bacteria. Thus are bacteriocidal. (gram positive bacteria has peptidoglycan, thus more susceptible than gram negative).

Indications

- Tonsillitis
- Pharyngitis
- Sinusitis
- Actinomycosis
- General infection
- Cephalosporins are given in patients allergic to penicillins

Adverse Reaction

- Anaphylaxis
- Skin rashes
- Serum sickness like fever
- GI upset
- Bone marrow depression

MACROLIDES

Examples

- Roxithromycin
- Azithromycin
- Clarithromycin
- Erythromycin
- Spiramycin

Mechanism of action

Binds to 50s ribosomal subunit, thus inhibits protein synthesis.

Indications

Similar to penicillin

Adverse reactions

- Nausea, vomiting, diarrhea
- Skin allergy.

SULFONAMIDES

Classification

1. Short acting
 - i. sulfadiazine
 - ii. sulfafurazole
2. Intermediate acting
 - i. sulfamazole
 - ii. sulfamethoxazole
3. Long acting
 - i. sulfamethoxine
 - ii. sulfadimethoxine
4. Topical
 - i. silver sulfadiazine – for burns
 - ii. mefanide – for burns
 - iii. sulfacetamide – eye drops
 - iv. sulfasalazine- oral, for inflammatory bowel disease.

Mechanism of Action

They inhibit bacterial DHF synthase, thus blocking first step in folate synthesis. They are bacteriostatic.

Indications

- Actinomycosis
- Upper respiratory tract infection (URTI)
- Urinary tract infections (UTI)

Adverse reactions

- Crystalluria
- S-J syndrome
- Agranulocytosis
- Allergic skin reactions
- Photosensitivity

Cotrimoxazole

- Trimethoprim + sulfamethoxazole (80 mg + 400 mg) (1 : 5)
- Both are bacteriostatic if used individually, but are bacteriocidal when used together. (drug synergism)

TETRACYCLINE (BROAD SPECTRUM ANTIBIOTIC)

Examples

- Tetracycline
- Doxycycline
- Minocycline
- Oxytetracycline
- Chlortetracycline

Mechanism of Action

Binds to 30s ribosomal subunit. Thus inhibits protein synthesis.

Indications

- Broad spectrum
- Alternate to penicillin in penicillin allergic patients.

Adverse Reactions

- Supra infections
- Growth retardation in children
- Dysgenesis in children
- Hepatotoxicity for infants if given to pregnant mother
- Teratogenicity
- Nausea, vomiting, diarrhea.

ANTIBIOTICS AND ANTIMICROBIAL AGENTS ACTING AGAINST ANAEROBIC ORGANISM

Examples:

- Metronidazole
- Ornidazole
- Secnidazole
- Tinidazole

Mechanism of Action

Breaks DNA helical structure and is Bacteriocidal.

Indications

- ANUG
- Amoebiasis and Giardiasis

- Trichomoniasis
- Pseudomembraneous colitis

Adverse Reactions

- Metallic taste
- Vomiting, headache
- Red coloured urine
- Antabuse like reaction with alcohols

PAIN CONTROL

The various methods of pain control in dentistry are:-

1. Use of NSAIDs (Non steroidal anti inflammatory drugs)
2. Use of Opioid analgesic
3. Use of Anesthetic agents (local anesthetic, conscious sedation, general anesthesia)
4. Acupuncture
5. Electric stimulation (TENS)

ANALGESIS (PAIN REDUCING DRUGS)

Classification

A. Opioids:- (Rarely used in dental practice)

1. Strong agonist
 - i. Morphine
 - ii. Pethedine
2. Mild to Moderate antagonist
 - i. Codeine
 - ii. Hydroxodone
3. Mixed antagonist/agonist
 - i. Pentazocine
 - ii. Tramadol
4. Pure antagonist
 - i. Naloxone
 - ii. Naltrexone
 - iii. Nalorphine

B. Non-steroidal Anti-inflammatory Drugs (NSAIDs)

1. Salicylates
 - i. Aspirin
 - ii. Sodium salicylate

2. Indoles
 - i. Indomethacin
 - ii. Sulindac
3. Propionic acid
 - i. Ibuprofen
 - ii. Ketoprofen
4. Paramino phenol
 - i. Paracetamol
5. Pyrrole
 - i. Ketorolac
6. Pyrazolones
 - i. Phenylbutazone
 - ii. Oxyphenbutazone
7. Oxicams
 - i. Piroxicam
 - ii. Meloxicam
8. Fenamate
 - i. Mefenamic acid
9. Furanones
 - i. Rofecoxib
 - ii. Celecoxib
10. Sulfoanilide
 - i. Nimesulide
11. Acetic acid
 - i. Diclofenac
12. Alkanone
 - i. Nabumetone
13. Benzoxazocine
 - i. Nefopam

Mechanism of Action

Inhibits COX 1 and COX 2, thus inhibits prostaglandin (PG) and TXA synthesis.

Effects

- Analgesic
- Anti-inflammatory
- Antipyretic
- Antiplatelet

Adverse Reactions

- GI upset (peptic ulceration and gastritis)
- Respiratory acidosis

- Metabolic acidosis
- Nephrotoxicity
- Hepato-renal failure
- Nausea, vomiting and diarrhea

Contraindications

- Gout
- Renal failure
- Children
- Asthmatics
- Peptic ulcers.

CORTICOSTEROIDS

Classification

1. Short acting (Natural)
 - i. Hydrocortisone
 - ii. Cortisone
2. Intermediate acting (Synthetic)
 - i. Prednisolone
 - ii. Methylprednisolone
3. Long acting (Synthetic)
 - i. Beclamethasone
 - ii. Betamethasone
 - iii. Dexamethasone
4. Inhaled
 - i. Beclamethasone
 - ii. Budesonide
 - iii. Fluticasone
5. Topical
 - i. Hydrocortisone
 - ii. Beclamethasone
 - iii. Betamethasone
 - iv. Fluticasone
 - v. Dexamethasone

Indications

1. Replacement therapy
 - i. Acute adrenal insufficiency
 - ii. Addison's disease
2. Pharmacological therapy
 - i. Arthritis
 - Rheumatoid arthritis
 - Osteoarthritis

- Gout
- Rheumatic arthritis
- ii. Collagen disorder
 - Systemic lupus erythromatosis (SLE)
 - Discoid lupus erythromatosis (DLE)
 - Nephritis syndrome
- iii. Allergic disorders
 - Anaphylaxis
 - Urticaria
 - Angioneuretic edema
 - Serum sickness
- iv. Autoimmune disorders
 - Pemphigus
 - Hepatitis
- v. Bronchial asthma
- vi. Pulmonary edema
- vii. Skin disease
 - Pemphigus
 - S-J syndrome
- viii. Cerebral edema
 - Tuberculous meningitis
 - Tumors
- ix. Malignancy
 - Hodgkin's disease
 - Leukemia
- x. Organ transplantation and skin grafting
- xi. Shock and septicemia.

Dental Indications

- i. Aphthous ulcer
- ii. Dental hypersensitivity
- iii. Desquamative gingivitis
- iv. Oral lichen planus
- v. Oral pemphigus
- vi. Postextraction edema.
- vii. Pulp capping
- viii. Pulpotomy
- ix. TMJ arthritis
- x. Oral submucous fibrosis (OSMF)
- xii. Intracanal medicament

Adverse Reactions

1. Mineralocorticosteroid
 - i. Sodium and water retention
 - ii. Edema
 - iii. Hypokalemic alkalosis
 - iv. Progressive rise in blood pressure
2. Glucocorticosteroid:
 - i. Cushing's syndrome
 - ii. Hyperglycemia
 - iii. Muscles weakness
 - iv. Susceptibility to infection
 - v. Delayed wound healing
 - vi. Osteoporosis
 - vii. Peptic ulceration
 - viii. Psychiatric disturbance
 - ix. Growth retardation
 - x. Suspension of hypothalamopituitary axis.

Contraindications

- Peptic ulcer
- Diabetes mellitus
- Hypertension
- Pregnancy
- Tuberculosis and other infection
- Osteoporosis
- Herpes simplex infection
- Psychosis
- Epilepsy
- Heart failure
- Renal failure

SKELETAL MUSCLE RELAXANTS

Classification

1. Centrally acting
 - Diazepam
2. Peripherally acting
 - i. Competitive blockers.
 - a. long acting
 - Tubocurarine
 - Pancuronium.

- b. short acting
 - Mivocuronium
 - ii. Persistent depolarisers
 - Scoline.
- 3. Directly acting
 - Dantrolene.

Indications

- Preanesthetic medication
- Status asthmaticus
- Status epilepticus
- Adjuvant to electroconvulsive therapy

Adverse Reactions

- G.I disturbances.
- Sedation
- Drowsiness
- Nausea, vomiting
- Diarrhea
- Malaise
- Scoline apnea with succinyl choline

HEMOSTATICS

These are locally applied agents which causes control in bleeding. They are:

1. **Adrenaline:** 0.5 ml of 1: 1000 adrenaline soaked in cotton plug is used to control bleeding of the gingival and epistaxis by its vasoconstriction action. It causes cardiac abnormalities if absorbed systemically.
2. **Thrombin:** Prepared from human or bovine plasma, is used as a freeze – dried powder or freshly prepared solution. Used in hemophilia, skin grafting and neurosurgery but never given by injection as can cause massive thrombosis and teeth.
3. **Fibrin foam:** Human fibrin is extracted, dried and an artificial foam is made into strips which are used as required.
4. **Absolute gelatin foam (gel foam):** Absolute as powder or porous substance and is best

used for packing wound and bleeding sockets.

5. **Oxidized cellulose (Oxycel):** These are surgical gauge treated with nitrogen dioxide and used to control bleeding from extracted socket.
6. **Oxidized regenerated cellulose:** These are modified oxygel which does not retard epithelization.
7. **Microfibrillar collagen hemostat:** These collagen product attracts platelets and triggers their aggregation.
8. **Styptics:** These are substances which precipitates surface protein without causing cell damage (astringent) and are used to control capillary bleeding. Application of large amount of styptics can cause tissue irritation and dry socket even. Commonly used styptics are:-
 - i. 5-10 percent aluminum chloride
 - ii. 20 percent ferric chloride/ferric sulphate
 - iii. 0.5-1 percent tannic acid
 - iv. Iron substances

Antibiotics Prophylaxis Regimens for Infective Endocarditis

Regimen	Antibiotic	Dosage
1. Standard oral regimen	Amoxicillin	2 gm 1 hour before procedure
2. Alternative regimen for patients allergic to amoxicillin, penicillin or both	Clindamycin	600 mg 1 hour before
	Azithromycin	500 mg
	or cephalexin	1 hour before 2 g 1 hour before
3. Patients unable to take oral medication	Ampicillin	2 g I.M or I.V within 30 min. before procedure
4. Patients unable to take oral medications and allergic to penicillin	Clindamycin	600 mg I.V within 30 min. before procedure
	or cepazolin	1 g I.M or I.V within 30 min. before procedure

Emergency Drugs for the Dental Office

General Drug Group	Common Examples
1. Parenteral preparations:-	
i. Analgesic	→ Morphine sulphate
ii. Anticonvulsant	→ Diazepam, midazolam
iii. Antihistamine	→ Diphenhydramine (Benadryl), chlorpheniramine
iv. Antipoglycemic	→ 50 percent dextrose in water, glucagon.
v. Corticosteroid	→ Methylprednisone (solumedrol), dexamethasone (Decadron), hydrocortisone (solu-cortef).
vi. Narcotic antagonist	→ Naloxone (Narcan)
vii. Sympathomimetic	→ Epinephrine
viii. vagolytic	→ Atropine.
2. Oral preparations:	
i. Antihistamine	→ Diphenhydramine (Benadryl)
ii. Antipoglycemic	→ Candy, fruit juice. Sugar.
iii. Vasodilator	→ Nitroglycerine (Nitrostat, nitrolingual).
3. Inhaled preparations:	
i. Bronchodilator	→ Metaproterenol (Alupent), epinephrine bitartrate (medihaler-Epi).
ii. Oxygen	
iii. Respiratory stimulant	→ Aromatic ammonia.

Drug Interactions Common in Dental Practice

No.	Drug	Interacting Drug	Effect Seen
1.	Antihistamine	CNS depressants	Increased drowsiness and sedation
2.	Salicylates (Asprin)	i. Anticoagulants (dicoumarin)	– Increases anticoagulant effect, thus more bleeding
		ii. Antacid	– Decreases aspirin action
		iii. Corticosteroids	– Increase GI bleeding
		iv. Oral hypoglycemic	– Increases hypoglycemic effect
		v. Phenytoin	– Increases antiepileptic effect
3.	Atropine	Alcohol	– Increases drowsiness
4.	Carbamazepine	Barbiturates, doxycycline, steroids.	– Decreases drug effect
5.	Corticosteroid	i. Antidiabetic drugs	– Increases hypoglycemia action
		ii. Antihypersensitivity drug	– Antagonism
		iii. Oral contraceptives	– Increases anti-inflammatory actions
6.	Cotrimoxazole	i. Diuretics	– Increases risk of thrombocytopenia
		ii. Anticoagulants, antiepileptic, oral hypoglycemic	– Increases action of these drugs
7.	Diazepam	CNS depressants	– Increases sedation effect
8.	Doxycycline	i. Penicillin	– Decreases penicillin action
		ii. Barbiturates and antiepileptic	– Decreases drug effect
9.	Metronidazole	i. Alcohol	– Antagonism
		ii. Antiepileptic	– Increases phenytoin toxicity
		iii. Anticoagulants	– Increases anticoagulant effect
		iv. Barbiturates	– Decreases drug effect
10.	Penicillin	Oral contraceptives	– Increases bleeding
11.	Tetracyclines	i. Oral contraceptives	– Increases bleeding
		ii. Oral hypoglycemic agents	– Increases hypoglycemic effect
		iii. Methotrexate	– Increases methotrexate toxicity

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Sterilization and Infection Control

4

DEFINITIONS

Sterilization

It is the process by which any article, surface or media is made free from all micro-organisms either in the vegetative or in sporing state.

Disinfection

It is the process by which the number of viable micro-organisms is reduced to an acceptable level, but may not inactivate some viruses and bacterial spores.

Disinfectant

It is a chemical substance which causes disinfection.

Cleaning

It is a process which removes visible contamination, but not necessary destroy microorganism. It is done prior to sterilization and disinfection.

Asepsis

It is the avoidance of pathological organisms, methods to prevent contamination of wound by letting only sterile objects to come in contact with the area. "NO TOUCH TECHNIQUE"

Antisepsis

It is the procedure or application of antiseptic solution. This inhibits micro-organisms growth

on tissues which are in contact with micro-organism. These include scrubbing and preparing of operational site.

Infection

It is the deposition of organisms in the tissue and their growth resulting in a host reaction.

Cross Infection

Transmission of infection among patients, practitioner's, practitioner's family, community, sources are – suffers and carriers (patient and practitioners).

CLASSIFICATION OF THE AGENTS USED IN STERILIZATION

Physical Agents

1. Sunlight
2. Drying
3. Filtration
 - i. Membrane filters
 - ii. Rapid and slow sand filters
 - iii. Earthen and asbestos filters.
4. Radiators
 - i. Ionizing radiations
 - ii. Non ionizing radiations.
5. Vibration
 - i. Sonic vibration
 - ii. Ultrasonic vibration

6. Heat

- i. Dry heat
 - Red hot flame
 - Flaming
 - Insineration
- ii. Moist heat
 - Below 100°C (Inspirator at 80-85°C)
 - At 100°C (Boiling water at 100°C)
 - Tyndilization at 100°C for 20 min.
 - Above 100°C (Autoclave)

Chemical Agents

1. Alcohol
 - Ethyl alcohol
 - Isopropyl alcohol
 - Methyl alcohol
2. Aldehyde
 - Formaldehyde
 - Gluteraldehyde
3. Dyes
 - Aniline
 - Acryline
4. Halogens
 - Iodide
 - Chloride
5. Phenol
 - Cresol
 - Chlorhexidine
6. Gases
 - Ethylene oxide
 - Formaldehyde
7. Surface active agents
 - Cationic salts
 - Anionic salts
 - Non-ionic salts.
8. Quaternary ammonium compounds (used to clean blood spills in hospitals)

Fumigation = Procedure for gas sterilization of operation theatre, wards and hospitals.

For a room of 1000 cc a box of 150 gm KMnO_4 (potassium permanganate) and 280 ml of formalin is mixed and kept. Formaldehyde gas is released which is allowed to circulate in the closed room for 24-72 hrs after which the gas is allowed to escape before being used.

AUTOClave (STEAM UNDER PRESSURE STERILIZATION)

Most commonly used method for sterilization in dental practice. It works on the principles of a pressure cooker, according to which when steam comes in contact with a cooler surface, it converts to water giving off its latent heat which is used for the sterilization procedure (Fig. 4.1).

Parameters Used

1. For light load of instruments:-
 - Temperature : 250°F (121°C)
 - Time : 15 minutes
 - Pressure : 15 lbs
2. For wrapped instruments:-
 - Temperature : 273°F (134°C)
 - Time : 7 minutes
 - Pressure : 130 lbs

Advantages

It is a rapid and most effective procedure for sterilization of cloth, surgical packs and towel packs where other methods cannot be used. Automated models are also available.

Disadvantages

Items sensitive to high temperature cannot be used. This method can rust carbon steel instruments and leads to coagulation of powder items.

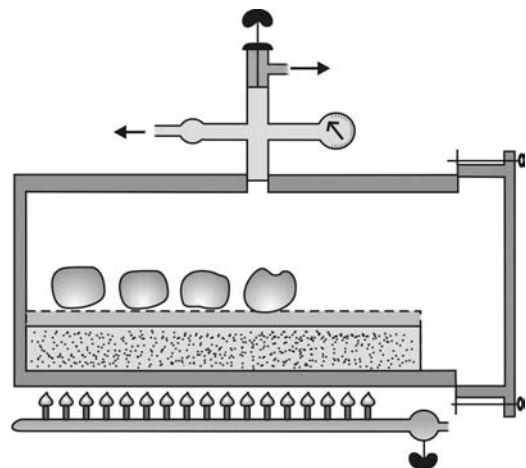


Fig. 4.1: Autoclave

CHEMICLAVE (CHEMICAL UNDER PRESSURE STERILIZATION)

Parameters Used

Temperature : 270°F (131°C)

Time : Half hour cycle

Pressure : 20 lbs

Chemicals like ethylene oxide is used instead of water for this procedure, thus the risk of rusting of carbon steel burs is reduced. But, ethylene oxide is hazardous for certain instruments and even for some patients.

DRYCLAVE (DRY HEAT STERILIZATION)

Parameters Used

Conventional Method

Temperature : 320°F (160°C)

Time : 30 minutes for individual instruments and for better result increase total time by 50 percent.

Short Cycle

Temperature : 370-375°F (210-215°C)

Time : 12 minutes (for wrapped instruments)

6 minutes (for unwrapped instruments)

Advantages

Carbon-steel burs and instruments do not rust, corrode or lose their temper or cutting edges if they are well dried before use. They usually provide larger space at low cost. Rapid cycles are possible at high temperature.

Disadvantages

High temperature may damage heat sensitive items like rubber or plastic instruments. Sterilization cycles are prolonged at low temperature. Heavy loads, crowding and heavy wrapping can deflect sterilization. They may not be automatically timed.

Inaccurate calibration, lack of setting and attention and addition of instrument without restoring are common errors.

BOILER (BOILING WATER AT 100°C)

Parameter Used

Temperature : 98°C-100°C (at sea level)

Time : 10 minutes

Boiling is not a very effective method of sterilization as it does not kill spores. It is used in cases where autoclaving or other methods are not being able to be used (like when sterilize is out of order). Boiling is at elevated temperature so it is better than other disinfectants used at room temperature. It destroys the blood borne pathogens. Pressure cookers etc are similar as it increases the temperature and creates condition similar to that in an autoclave.

Action of Disinfectants and Antiseptics

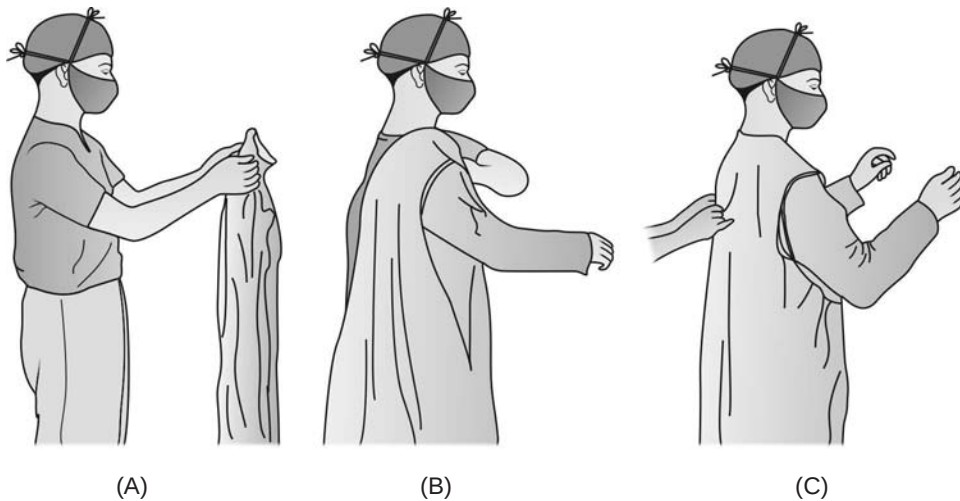
- Coagulation of bacterial proteins
- Alteration in the properties of bacterial cell wall.
- Binding of sulphhydryl groups or essential for enzyme action.
- Competition with essential substrate for the important enzymes in bacterial cell.

Principles of Sterilization

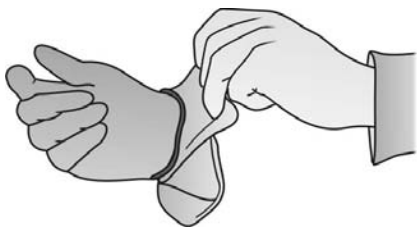
- All used instruments should be properly cleaned of blood and debris before sterilization
- It is essential for the sterilization agent (heat, steam or gas) to be in contact with every surface of each item to be sterilized for the specified period of time at the specific temperature.
- All sterilizing equipment must be regularly serviced and maintained by suitably qualified engineers.
- The manufacturer's instructions should be strictly followed for its operation and maintenance.

Methods of Sterilization or Disinfection of Selected Dental Instruments

Items	Steam autoclave	Dry heat oven	Chemical sterilization (rarely used)
	15–30 min. required per cycle	1-1/2 hours required per cycle	
Stainless inst. (loose), restorative burs.	+ +	++	–
Instruments in packs	+ +	+ (small packs)	–
Instrument tray set ups, surgical or restorative	+	++	–
Rustable instruments	(size limit) (only when coated with chemical protectant)	++	–
Hand piece (autoclave)	++	–	–
Hand piece (non autoclave)	–	–	+ (iodophor disinfectant)
Angle attachment	+	+	–
Rubber items	++	–	–
Rag wheels	++	+	–
Removable prosthetics	–	–	+ (sodium hypochlorite)
Heat-resistant plastic evacuators	++	+	–



Figs 4.2A to C: Draping of operator: (A) Drape is held straight before wearing; (B) First right side is draped followed by the left; (C) The nurse tightens the drape in position



(A) Gloving right hand



(B) and (C) Gloving left hand

Figs 4.3A to C: (A) The cuff of the right hand gloves is held and worn first;
(B) and (C) The left hand cuff is held followed by complete gloving of the operator



Fig. 4.4: Patient preparation

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Armamentarium and their Usage in Oral and Maxillofacial Surgery

5

Explorer (dental probe) (Fig. 5.1)

- It is long, thin double ended instrument.
- It is used for exploring and diagnostic purposes.



Fig. 5.1: Explorer (dental probe)

Mouth Mirror (Fig. 5.2)

- It has two parts—the mirror top and the handle.
- It is used for reflection (for better visualization) and also for retraction.



Fig. 5.2: Mouth mirror

Dissection Forceps (Fig. 5.3)

- It is a straight, long forcep with a blunt nose.
- It is used to hold and retract tissues during dissection.



Fig. 5.3: Dissection forceps (college type)

Sponge Holder (Fig. 5.4)

- It is an instrument with long blades, expanded at the ends, forming an oblong tip.

- It is used to hold swab or sponge and clean the area of operation, to press on the tonsillar bed to arrest hemorrhage and hold the tongue & give anterior traction to prevent airway obstruction.

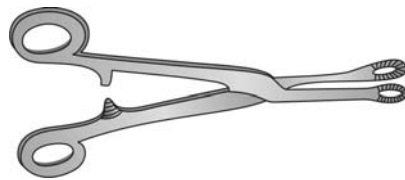


Fig. 5.4: Sponge holder

Cartridge Syringe (Figs 5.5A and B)

- Cartridge syringe are of two types: (a) Breech loading aspirating type (b) Breech loading, self aspirating type. In cartridge syringes (metal and plastic) anesthetic cartridges are used.
- Plastic disposable syringe are available in different sizes and contain a luer lock screw on needle attachment but no aspirating tip.

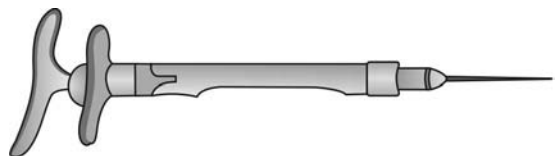


Fig. 5.5A: Cartridge syringe



Fig. 5.5B: Plastic disposable syringe

Cheatel Forceps (Fig. 5.6)

- It has two lengthy, heavy square shaped blade with slight curvature at the tip. Blades are angulated. No ratchet at handle.
- Used to hold other instruments

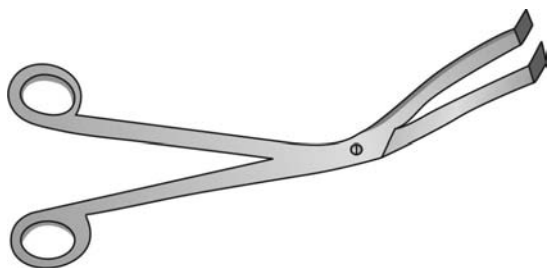


Fig. 5.6: Cheatel forceps

Towel Clip (Fig. 5.7)

- It is like an artery forceps with ratchet. Has pointed curved ends (tongue forceps)
- Used to severe drape in position.

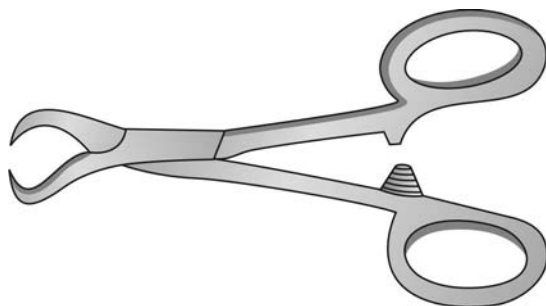


Fig. 5.7: Towel clip

Upper Anterior Dental Extraction Forceps (Fig. 5.8)

- It is an instrument for the extraction of teeth so designed as to apply forceps with the optimum mechanical advantage of a pair of short blades through a joint in the handles.
- Beaks are parallel or in line with handle.
- Tip of both beaks are mirror image (rounded tips)
- Used for removal of whole tooth all upper anterior both right and left.

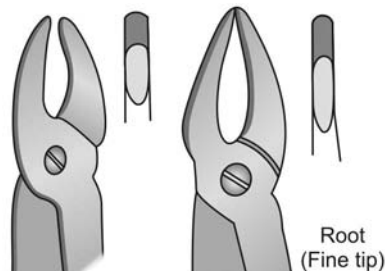


Fig. 5.8: Upper anterior dental extraction forceps

Root Forceps

- These are forceps with blades which are designed to embrace the roots of teeth. The blades are made in a variety of widths and lengths.
- Root forceps are used for removal of accessible root pieces of upper anteriors

Upper pre-molars Dental Extraction Forceps (Fig. 5.9)

- Beaks are slightly angulated to handle set in an "S" curve in view for good access
- Tips of both beaks are mirror image (rounded tips)
- Used for removal of whole tooth all upper pre-molar both right and left.

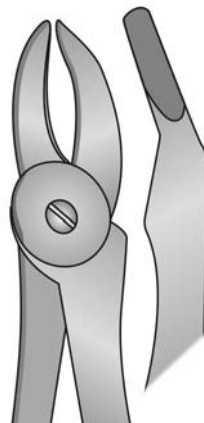


Fig. 5.9: Upper pre-molar dental extraction forceps

Upper Pre-molar Root Extraction Forceps (Fig. 5.10)

- It is a fine tipped long shanked instrument.
- Used for removal of accessible root piece of pre-molars both right and left.

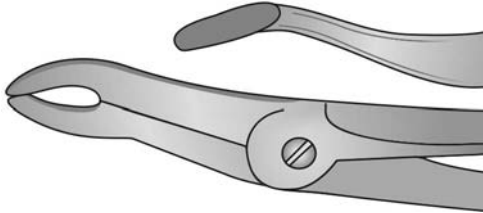


Fig. 5.10: Upper premolar root extraction forceps

Right Upper Molar Dental Extraction Forceps (Fig. 5.11)

- Beaks are slightly angulated to handle
- One of the beak tip is modified as pointed (eagle's beak) and other tip rounded.
- Used for removal of whole tooth-upper left 1st and 2nd molars.

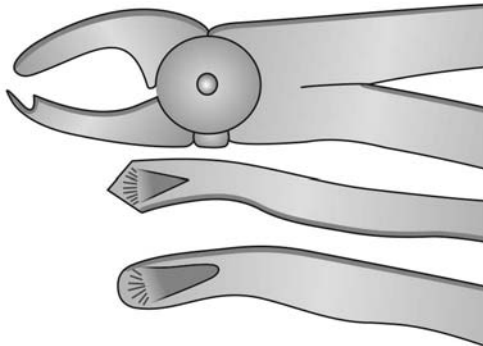


Fig. 5.11: Right upper molar dental extraction forceps

Left Upper Molar Dental Extraction Forceps (Fig. 5.12)

- Beaks are slightly angulated to handle
- One of the beak tip is modified as pointed (eagle's beak) and other tip rounded.
- Used for removal of whole tooth-upper left 1st and 2nd molars.

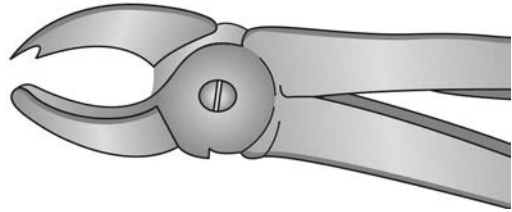


Fig. 5.12: Left upper molar dental extraction forceps

Bayonet Forceps (upper root) (Fig. 5.13)

- Root forceps for use in upper posterior teeth in which shanks are contra angled for ease of access.
- Has binangled beak, fine tipped
- Both the beaks are mirror image
- Used for removal of accessible root pieces in upper molars both right and left.

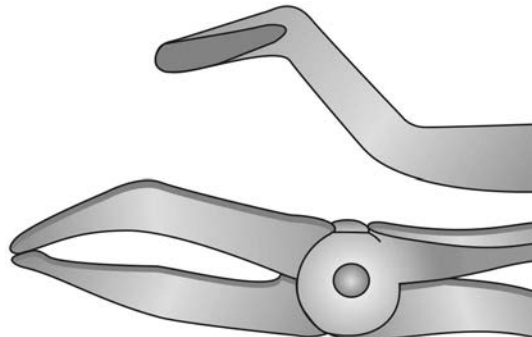


Fig. 5.13: Bayonet forceps (upper root)

Upper Third Molar Forceps (Fig. 5.14)

- Has Binangled shank or blades
- Tips of the beaks are rounded and mirror imaged.

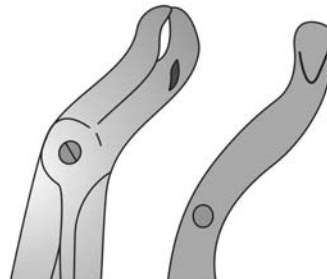


Fig. 5.14: Upper third molar forceps

*Root Separator (upper)-
Cow Horn Forceps (Fig. 5.15)*

- Forceps with side cutting blades
- Used for splitting roots in multirooted teeth when tooth has broken at C.E junction or in badly decayed tooth.

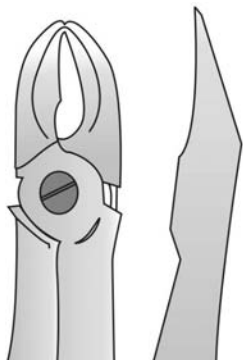


Fig. 5.15: Root separator (upper)

Lower Anterior Dental Extraction Forceps (Fig. 5.16)

- Beaks right angle to handle.
- Has rounded tips, tips of both beaks are mirror image
- Used for removal of whole tooth-lower anteriors both right and left
- Root forceps are fine tipped
- Used for removal of accessible root pieces of lower anteriors
- Close contact between beaks when closed.

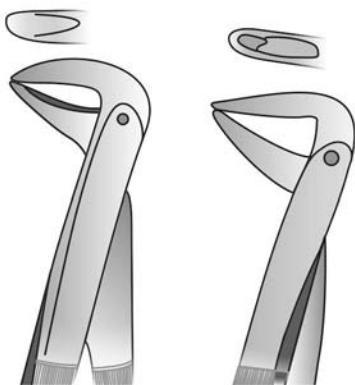


Fig. 5.16: Lower anterior dental extraction forceps

Lower Pre-molar Dental Extraction Forceps (Fig. 5.17)

- Beaks almost right angled to handle
- Has rounded tips, tips of both beaks are mirror image
- Has a gap between both beaks
- Blade width is more than lower anterior forcep
- Used for removal of whole lower pre-molar tooth both right and left.

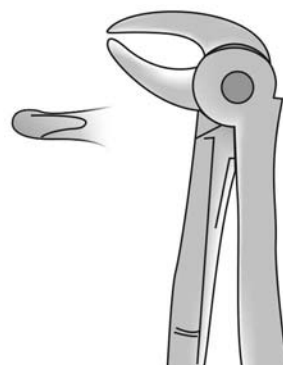


Fig. 5.17: Lower pre-molar dental extraction forceps

Lower Pre-molar Root Forceps (Fig. 5.18)

- It is a fine tipped, little lengthy beaked forcep
- Close contact between beaks when closed
- Used for removal of accessible lower pre-molar roots both right and left.

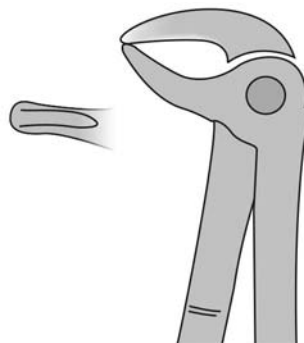


Fig. 5.18: Lower pre-molar root forceps

Lower Molar Dental Extraction Forceps (Fig. 5.19)

- Beaks are almost right angled to handle
- Both the beaks tips are pointed (eagle's beak)
- Used for removal of whole tooth-lower molars both right and left.

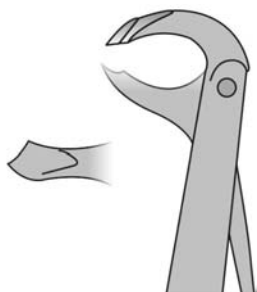


Fig. 5.19: Lower molar dental extraction forceps

Root Separator (lower)-cow Horn (Fig. 5.20)

- Used for splitting lower molar roots when tooth breaks at c.e junction and roots are intact.



Fig. 5.20: Root separator (lower)

Coleman Elevator (separated blade) (Fig. 5.21)

- It is a straight elevator
- Used in first class lever mainly with wheel and axle.

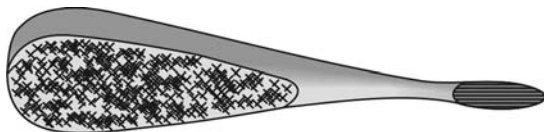


Fig. 5.21: Coleman elevator (separated blade)

Coupland's Elevator or Chisel (Fig. 5.22)

- This is not a true chisel but a hand gauge made with varying widths of blade attached to an octagonal pear shaped handle
- Used in wedge principle mainly with first class lever or wheel and axle.

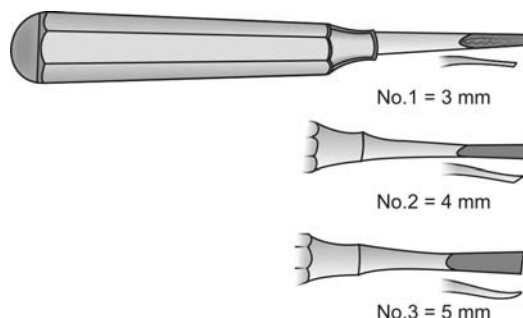


Fig. 5.22: Coupland's elevator or chisel

Apexo Elevators (Fig. 5.23)

- Straight - used in wedge with first class lever or wheel and axle principle.
- Angled - used in wedge with first in class lever principle.

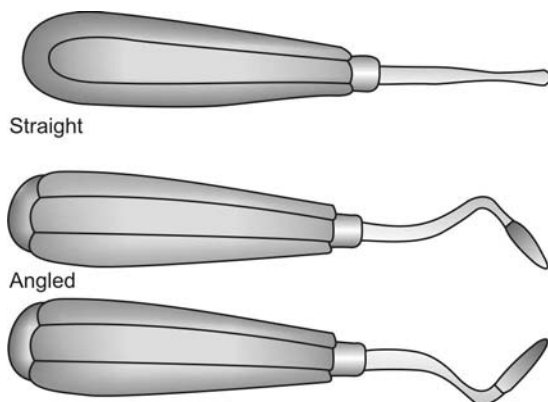


Fig. 5.23: Apexo elevators

Lendo Levien Elevator (Fig. 5.24)

- Used in first class liver- with wedge or wheel or axle principle.



Fig. 5.24: Lendo levien elevator

Winter's Cross Bar Elevator (Fig. 5.25)

- It is a set of paired levers with cork screw pattern handles and various shaped points or blades.
- The blade of this instrument is triangular in shape at end at 45 angulation to shaft.
- Used in wheel and axle mainly with first class lever principle.

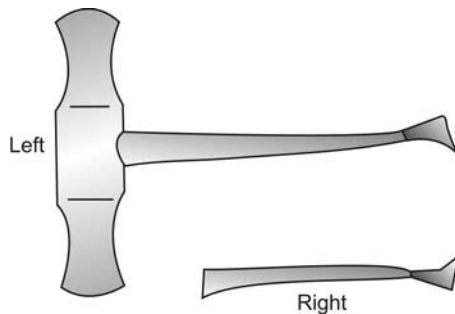


Fig. 5.25: Winter's cross bar elevator

Cryer's Elevator (Fig. 5.26)

- Used in wheel and axle mainly with first class lever principle.

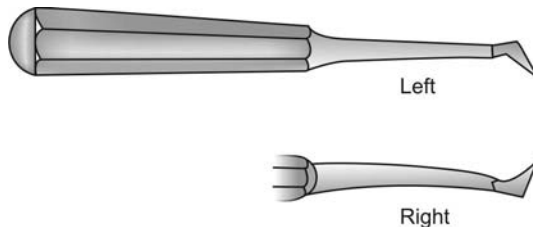


Fig. 5.26: Cryer's elevator

Warwick James Elevator (Fig. 5.27)

- It is a set of three instruments, used for removing root fragments and impacted tooth. The handles are flattened elongated and non-serrated. The blades are small and smooth. One with straight blade and two with curved angulated.
- Straight - used in first class lever mainly with wheel and axle principle.
- Angulated - used in wheel and axle mainly with first class lever principle.

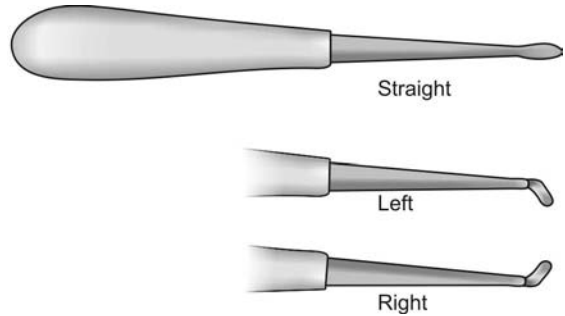


Fig. 5.27: Warwick james elevator

Hospital Pattern Elevator (Fig. 5.28)

- Used in wheel and axle mainly with first class lever principle.

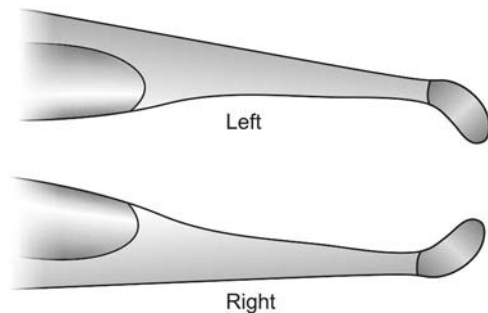


Fig. 5.28: Hospital pattern elevator

Moon's Probe (Fig. 5.29)

- It is a flat, almost right angled blade with tip blunt and half moon shaped.
- Used to detach epithelial attachment.



Fig. 5.29: Moon's probe

Dental Mouth Prop (Fig. 5.30)

- It is a non-adjustable intra-oral device used to keep the mouth open
- Used to maintain mouth opening in prolonged surgery.

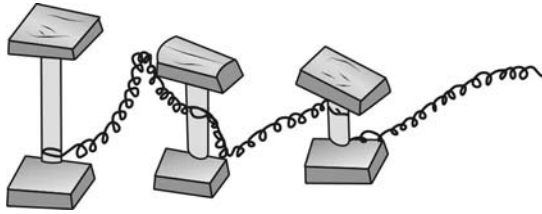


Fig. 5.30: Dental mouth prop.

Surgical Blades (Fig. 5.31)

- It is designed to fit into Bard parker handle available in numbers and shapes
 - No. 10- skin incision
 - No. 11- drainage of an abscess: excision of fistulous tract
 - No. 12- incision in palatal aspect: distal to last molars: incision of marginal gingivae
 - No. 15- incision in accessible area (commonly used)

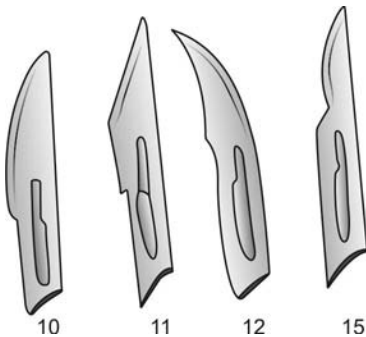


Fig. 5.31: Surgical blades

Howarth Periosteal Elevator (Fig. 5.32)

- It is a hand instrument designed to strip the mucoperiosteum from the underlying bone following an incision
- Used for mucoperiosteal reflection in pen grasp and push or pull or pry stroke.



Fig. 5.32: Howarth periosteal elevator

Ward Periosteal Elevator (Fig. 5.33)

- Used for mucoperiosteal reflection



Fig. 5.33: Ward periosteal elevator

Periosteal Elevator (Fig. 5.34)

- Used for mucoperiosteal reflection



Fig. 5.34: Periosteal elevator

Retractors

- It is an instrument designed to displace the soft tissues to improve vision, access and afford them protection during surgical procedures. They are divided into groups according to the tissue concerned.

Kay's Modified Austin Retractor (Fig. 5.35)

- It is a flat bladed right angled instrument with the end rounded other end serrated or saw type.
- Used to retract tissue gently and steadily away from operative field.

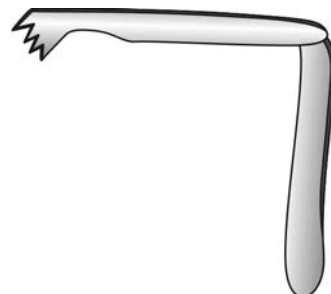


Fig. 5.35: Kay's modified austin retractor

Kilner Skin Retractor (Fig. 5.36)

- Used to retract deeper tissues to facilitate deeper dissection.



Fig. 5.36: Kilner skin retractor

Rowe Maxillary Labial Retractor (Fig. 5.37)

- It is a flat blade instrument with both the ends curved and rounded tips
- Used to retract labial mucoperiosteum.



Fig. 5.37: Rowe maxillary labial retractor

Langenbeck Retractor (Fig. 5.38)

- Used to retract deeper tissue and to facilitate deeper dissection.

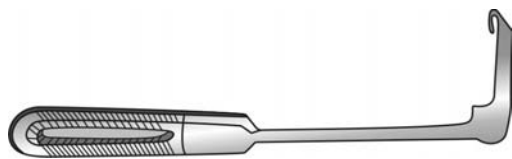


Fig. 5.38: Langenbeck retractor

Cheek Retractor (Fig. 5.39)

- Used to retract angle of mouth and cheek for orthodontic and photographic purpose.

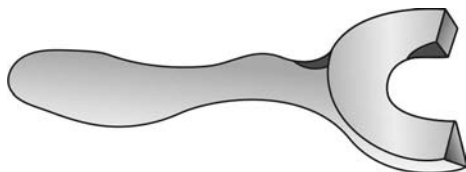
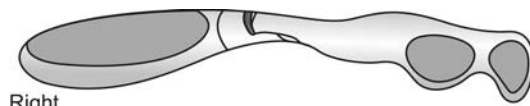


Fig. 5.39: Cheek retractor

Hovell Lingual Flap Retractor (Fig. 5.40)

- Used to retract lingual flap of third molar during impaction.



Right



Left

Fig. 5.40: Hovell lingual flap retractor

Ward Cheek Retractor (wisdom tooth) (Fig. 5.41)

- Used to retract both buccal flap and cheek during lower impaction

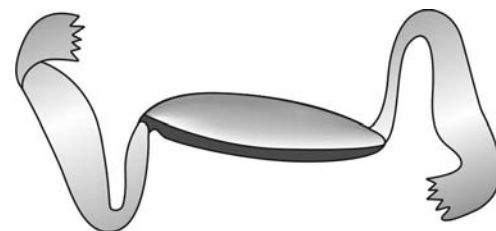


Fig. 5.41: Ward cheek retractor (wisdom tooth)

Aufright Retractor (Fig. 5.42)

- Used to retract deeper soft tissues to facilitate deeper dissection

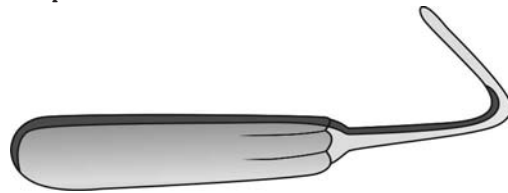


Fig. 5.42: Aufright retractor

Jenkin's Chisel (Fig. 5.43)

- It is a bone cutting instrument having a handle and blade which is composed of two flat surfaces, one of which is beveled to meet

the other and cutting edge is at one side. It is used with mallet.

- Used to cut bones
- Used to join holes in postage stamp method.



Fig. 5.43: Jenkin's chisel

Gouge (Fig. 5.44)



Fig. 5.44: Gouge

Gillies Osteotome (Fig. 5.45)

- It is a bone splitting instrument in which the two flat surfaces of the blade are ground to meet each other to form a wedge. Cutting edge is in the centre. It is used with mallet to cleave the bone.
- Used to split the bone
- Used to split the tooth



Fig. 5.45: Gillies osteotome

Jenkin's Gouge (Fig. 5.46)

- It is an instrument similar in handle and shaft to a chisel but having a concave round ended, cutting blade.
- Used to create round shaped window in bone.



Fig. 5.46: Jenkin's gouge

McIndoe Nasal Chisel (Fig. 5.47)

- It is a bone splitting instrument having handle and blade which is composed of two flat surfaces one of which is beveled to meet the

other and cutting edge is at one side and half moon shaped (concave)

- Used to separate nasal septum from palatine crest.



Fig. 5.47: McIndoe nasal chisel

Kelsey Fry Mallet (Fig. 5.48)

- Its head is cylindrical, made of metal, sometimes plastic or wooden faced, obtained in various weights
- Used in pull motion.

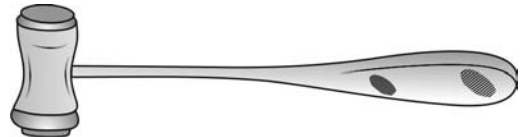


Fig. 5.48: Kelsey Fry mallet

Surgical Burs (Fig. 5.49)

- Has a long shank with wide pitch between blades
- Toller's no. 6 or 8
- Rose head 4 or 8.

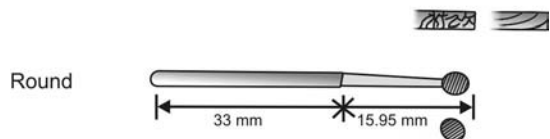
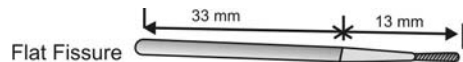


Fig. 5.49: Surgical burs

Volcanite Burs (Fig. 5.50)

- Used to trim and smoothen the sharp margins and elevations



Fig. 5.50: Volcanite burs

Bone Rongeurs (ward: double action) (Fig. 5.51)

- It is a double handled instrument making use of the mechanical advantage of handle - joint- blade ratio to apply force to cup shaped cutting blades.
- Used to remove bone by plaining action
- To enlarge bony wall of cyst
- To remove peripheral (projection) bone.

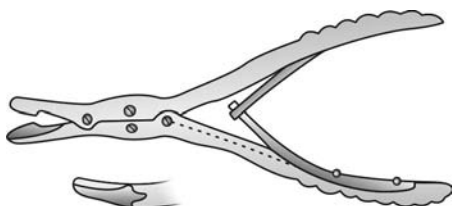


Fig. 5.51: Ward rongeurs (double action)

Bone Shears (Fig. 5.52)

- It is a similar instrument to bone rongeurs but with knife or chisel shaped blades.
- Used to remove bone by shearing action
- Also used to remove sharp projection bone

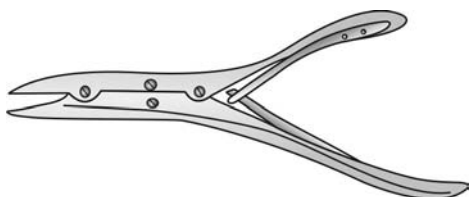


Fig. 5.52: Bone shears

Bone Rasp or File (Fig. 5.53)

- It is a double ended instrument with serrated cutting blades used to smooth down irregular bone.
- Used for final trimming of the bony ridge after gross removal with rongeur.
- Used only in pull stroke.



Fig. 5.53: Bone file (alveolecting)

Fickling Forceps (angled) (Fig. 5.54)

- Its blades are angulated, having single toothed notch interdigitate during closure. Has ratchet at handle.
- Used to remove detached bone pieces
- Also used to remove tooth pieces

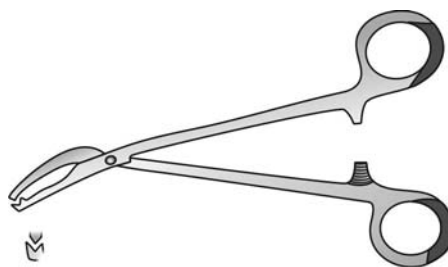


Fig. 5.54: Fickling forceps (angled)

Alli's Tissue Forceps (Fig. 5.55)

- It has long beaks with 2 or 3 toothed type tips interdigitate while closure. Ratchet present.
- Used to grasp tissue during dissection.

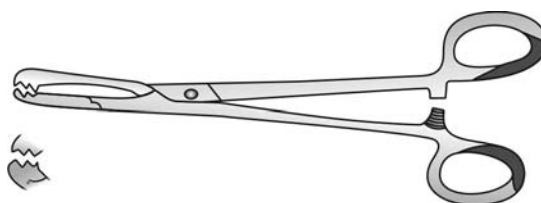


Fig. 5.55: Alli's tissue forceps

Read curette (Fig. 5.56)

- It is a spoon shaped instrument designed to remove soft infected tissues.
 - Used to explore the apices of sockets
 - Also used to enucleate granuloma, soft tissues, tumors, cysts.

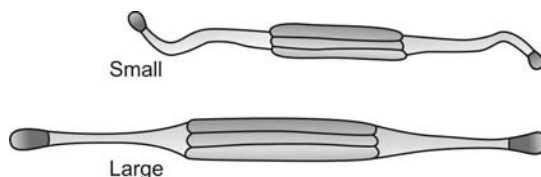


Fig. 5.56: Read curette

Suture Needles (Figs 5.57 and 5.58)

- Used to carry suture thread and to pass these through the tissue. Available in various shapes with either cutting or reverse cutting or round bodied with eyes, closed or frenched type or swaged.

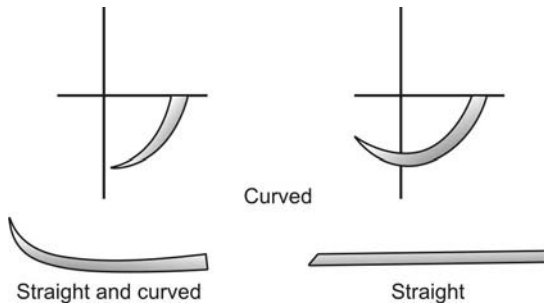


Fig. 5.57: Suture needles

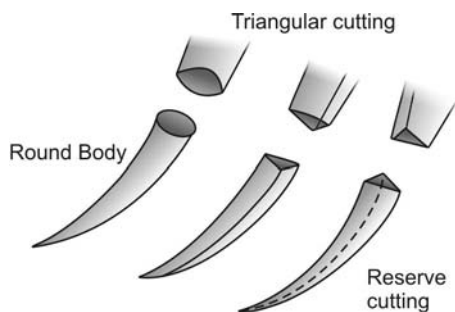


Fig. 5.58: Suturing needles

Needle Holder

- It is an instrument having blades, which grip curved needles without rotation. Variations are to be found in those with or without ratchets. One blade perforated for end holding of needles. Inside criss cross striation with central groove on opening. Some times come with scissors behind the blades.
- Gillies scissors and needle holder
- It helps in suturing and cutting.

Mayo Needle Holders (Figs 5.59A and B)

- It has criss cross striated with central groove

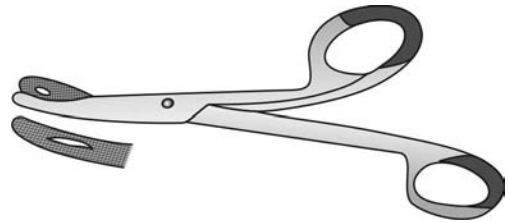


Fig. 5.59A: Gillies scissors and needle holders (No ratchets)

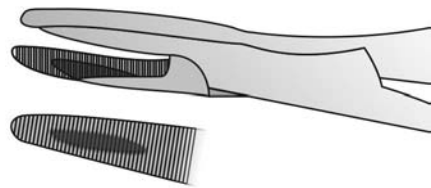


Fig. 5.59B: Mayo needle holder (with ratchets)

Dissection Forceps (toothed) (Figs 5.60A to C)

- It is a fine bladed forceps with tooth. The tip is used for grasping the mucosal flaps while suturing or to hold the suture needle.
- Used to pick up small detached pieces.



Fig. 5.60A: Gillies dissecting forceps (toothed)



Fig. 5.60B: Lead dissecting forceps (toothed)



Fig. 5.60C: Adson fissure forceps

Non-toothed Dissecting Forceps (Fig. 5.60D)

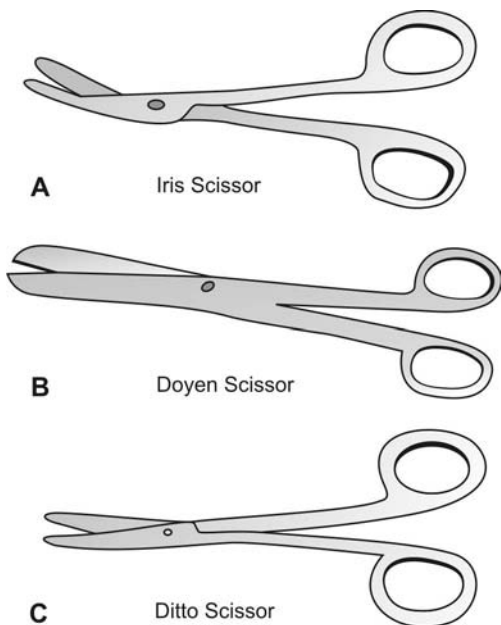
- Used to hold knot while removing sutures



Fig. 5.60D: Non-toothed dissecting forceps

Scissors (Figs 5.61A to C)

- Are of various shapes with long pointed or round shaft with cutting edge one side. Straight or curved.



Figs 5.61A to C: Scissors

Artery Forceps (Figs 5.62A to C)

- Has long and also medium sized blades. Either curved or straight. Has transverse serration on the inner aspect of blades. Ratchets present.
- Used to clamp bleeding points
- To remove tooth fragments and root tips
- To hold or grasp tissues such as follicles or cyst membrane.

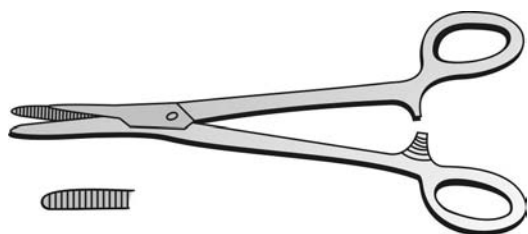


Fig. 5.62A: Forceps (Straight) crile artery

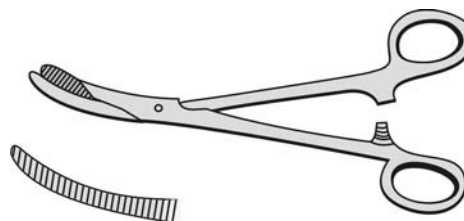


Fig. 5.62B: Forceps (curved) crile artery

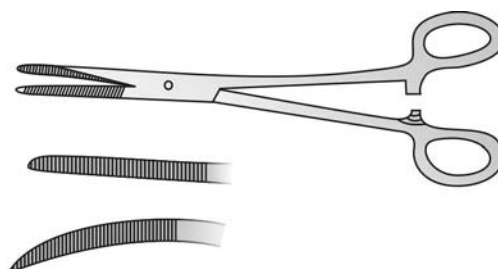


Fig. 5.62C: Fochester peah artery (Forceps)

Mosquito Artery Forceps (Fig. 5.63)

- To clamp bleeding points

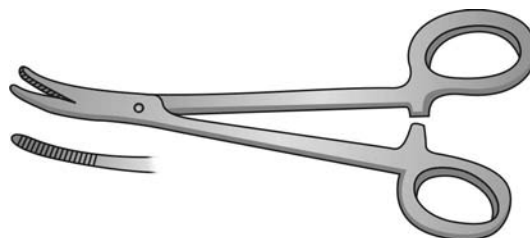


Fig. 5.63: Mosquito artery forceps

Lister Sinus Forceps (Fig. 5.64)

- Has long blades with rounded flat tip, transverse serration at the tip on inner aspect. No ratchets on the handle.
- Used to explore the potential spaces to drain an abscess

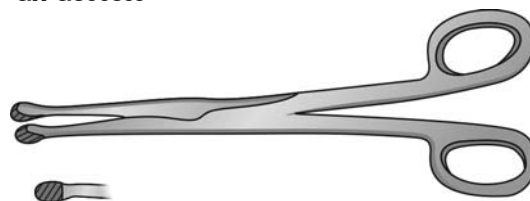


Fig. 5.64: Lister sinus forceps

Skin Hook (Gillies) (Fig. 5.65)

- Has fine hook set on the slender shaft of a delicate handle. Their main purpose is to control the skin flaps when suturing.
- Used to control skin flap while suturing.

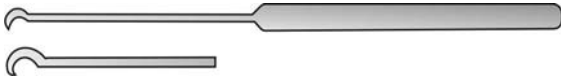


Fig. 5.65: Gillies skin hook

Higginson's Chip Syringe (Fig. 5.68)

- Has a rubber bulb with nozzle, sterilizable.
- Used for saline irrigation during bone removal with bar.

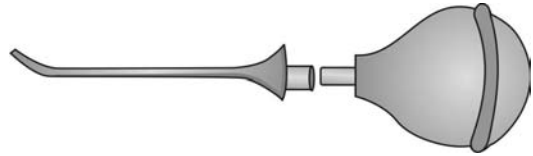


Fig. 5.68: Higginson's chip syringe

Hayton Williams Wire Twister (Fig. 5.66)

- Has short round tipped like needle holder but has transverse serrations on the inner aspect of beak. Presence of ratchet in handle.
- Used for twisting wires and tucking.



Fig. 5.66: Hayton Williams wire twister

Metal Head Frame (Fig. 5.69)

- Has band of metal with varying design attached to the head by screws which are inserted through short incisions, these screws contact inside of the skull frame is used for the attachment of various devices, to immobilize fracture of facial skeleton. For example, Halo head frame, Andre charest head frame, Crawford head frame.
- Used for cranio- maxillary fixation, cranio-mandibular fixation, and cranio-zygomatic fixation.

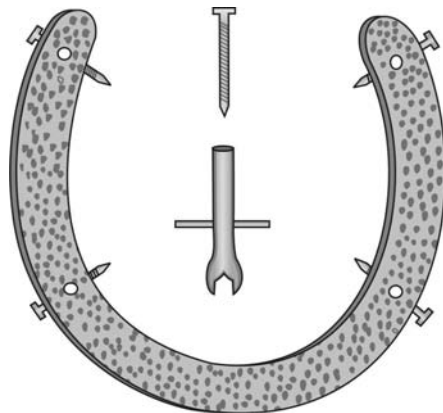


Fig. 5.69: Hallow frame

Wire Cutter (Fig. 5.67)

- It is available in scissors type having short beak with side cutting blades or cutting plier type.
- Used to cut sutural wires



Fig. 5.67: Wire cutter

Walshan's forceps (Figs 5.70A to C)

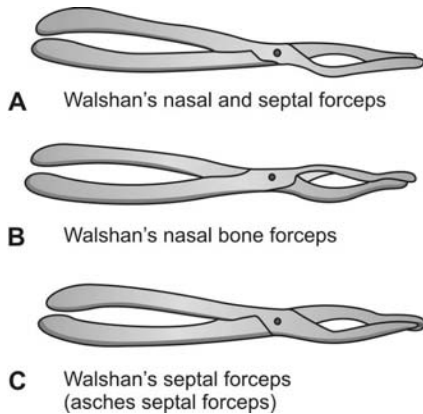
Nasal bone forceps: It is a set of two forceps right and left. One blade of the forceps is designed to be inserted into the nasal cavity and

the other shaped to fit the outside of the appropriate nasal bone.

- Used to reduce nasal bone fracture.

Septal forceps: Have straight flat oval ended blades, which is applied one on either side of the nasal septum to straighten the nasal septum.

- Used for nasal septal correction.



Figs. 5.70A to C: Walshan's forceps

Maxillary Disimpaction Forceps (Rowe's) (Fig. 5.71)

- One blade of forcep is designed to pass into the nasal cavity and the other blade designed to fit against the palate (padded) so that the maxilla may be grasped and manually disimpacted.
- Used to reduce impacted or delayed Le Fort fractures.

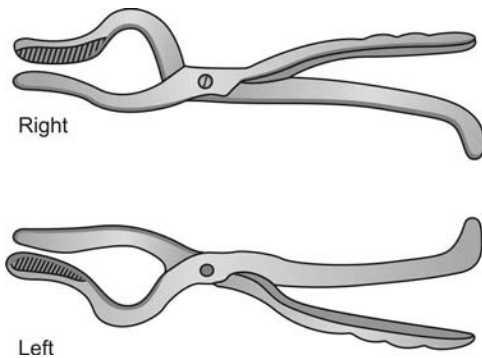


Fig. 5.71: Rowe's maxillary disimpaction

Hayton-Williams Forceps (Fig. 5.72)

- Used to reduce mid palatine split.



Fig. 5.72: Hayton-Williams forceps

Rowe's Modified Harrison Mandible Holding Forceps (Fig. 5.73)

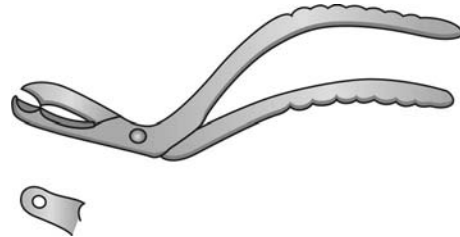


Fig. 5.73: Rowe's modified Harrison mandible holding forceps

Malar Bone Elevators (Fig. 5.74)

- Three types of elevators named after persons designed, used for elevating the depressed zygoma through gillie's approach.

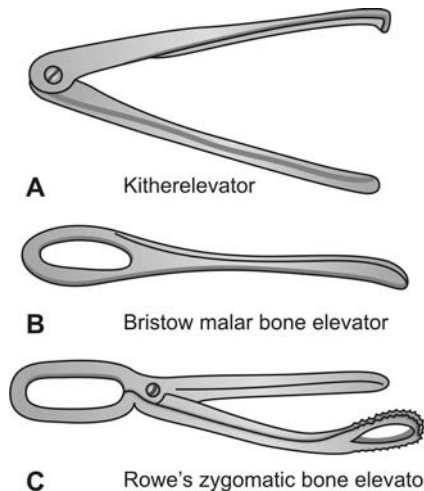


Fig. 5.74: Malar bone elevators

Collin Reverdin Needle (Fig. 5.75)

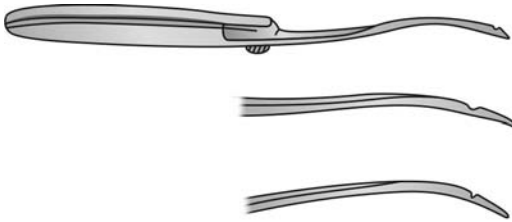


Fig. 5.75: Collin Reverdin needle

Rowe's Zygomatic arch AWL (Fig. 5.76A)

- Used for circum zygomatic suspension wiring.



Fig. 5.76A: Rowe's zygomatic arch AWL

Kelsey Fry Bone AWL (Curved)

- Used for circumferential (circummandibular) wiring

Kelsey Fry Bone AWL (straight) (Fig. 5.76B)

- Used for per alveolar wiring



Fig. 5.76B: Bone AWL

Ferussan's Mouth Gag

- It is a two handled adjustable jointed instrument inserted between the jaws in order to forcefully open them. They are applied between teeth.
- Used to increase mouth opening forcefully.
- Also used for jaw exercise after the surgery in adult.

Doyen Mouth Gags

- It is of small size, used in children.

Obwegessor's Ramus Retractor (Fig. 5.77)

- It is similar to Langenback's retractor except that the edge of the retracting blade is forked, forming a 'V' shaped notch so as to engage the anterior border of the ramus.
- Used to retract the soft tissues along the anterior border of ramus.



Fig. 5.77: Obwegessor ramus retractor

Babcock's Tissue Holding Forceps (Fig. 5.78)

- The instrument has fenestrated blades without teeth.
- It is used to hold the intestines and delicate structure like peritoneum, fascia, appendix and enlarged lymph nodes.

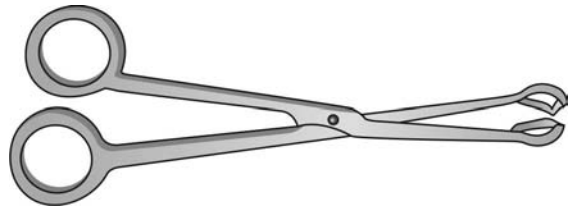


Fig. 5.78: Babcock's tissue holding forceps

Chin Retractor (Fig. 5.79)

- It is a long, curve ended instrument used for retracting the chin in case of genioplasty, chin reduction, and other procedures involving chin.

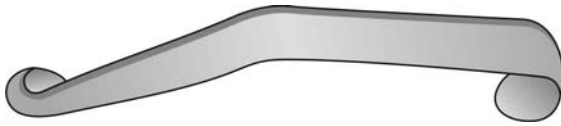


Fig. 5.79: Chin retractor

Volkman's Bone Scoop (Fig. 5.80)

- It is a instrument similar to a curette, but the concavity of the working edges is more pronounced.
- It is used to scrape the contents of a bony cavity, due to cystic/tumourous lesions.
- Also used to introduce graft material, antiseptic powder into the surgical area.

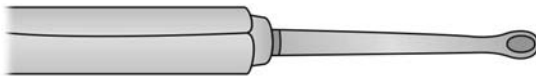


Fig. 5.80: Bone scoop

Bone Spreader (Fig. 5.81)

- It has three blades that are separated by spring action when the handles are compressed.
- It is used to separate the bony fragments after completion of the osteotomy cuts.
- It is mainly used to check for the separation of the fragments during down fracture of the maxilla or during sagittal split osteotomy procedure.

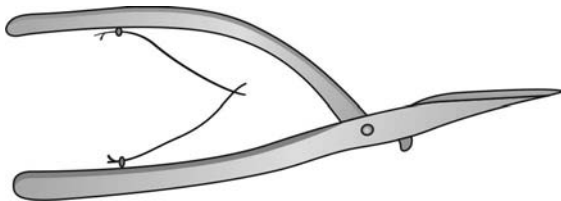


Fig. 5.81: Bone spreader

Suction Tips (Fazier type) (Fig. 5.82)

- These are the instruments, which are introduced into the surgical field for maintaining a clean field by sucking away

blood, flushing solution, debris, cystic fluid, pus and secretions.

- Frazier suction tip has a blade in the handle for better control and a hole to control the suction speed.

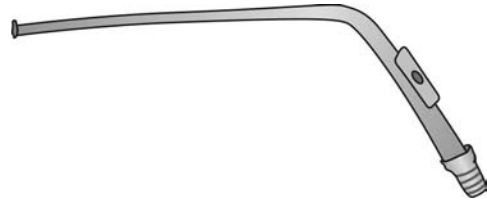


Fig. 5.82: Suction

Corrugated Rubber Dam

- Corrugated rubber drain is a sheet of rubber with corrugations on its surface.
- It is usually used as a drain following abscess drainage. Multiple holes are usually made in the drain to prevent the drain from getting obstructed. The drain is inserted with one end in the cavity and another end is left in place for three to five days. It is secured to the skin by sutures.

Endotracheal Tube

- It is flexible plastic tube that is put in the mouth and then down into the trachea.
- The tube is inserted under direct vision with the help of laryngoscope. The purpose of this tube is to ventilate the airway during general anesthesia.
- It can be cuffed and non-cuffed.

Erich's Arch Bar

- It contains a thin stainless steel strip that has hooks incorporated on it. It is malleable and can be adapted to the contour of maxillary and mandibular arch and fixed on the teeth with the help of wires.
- It is used to stabilize dentoalveolar fracture and mandibular fractures that are to be treated by closed reduction.

Ryle's Nasogastric Tube

- It is a long hollow tube with one blunt end with multiple openings and an open end. The blunt end is passed through the nostril into the stomach. To check the position of the tube air is pushed into the tube with the help of a syringe and checked in stomach with stethoscope.
- It is used to provide feeds to the patients who cannot take oral feeds.
- It is also used to provide gastric lavage post operatively to flush out blood, fluids ingested intraoperatively.

Foley's Self-Retaining Catheter (Fig. 5.83)

- It is catheter with self retaining mechanism, which is in the balloon near its tip. At the other end of the catheter two tubes are present. The wider tube is meant for draining the urine and the narrower communicates with the balloon.
- It is used for evacuation of bladder in long cases under general anesthesia, and also in unconscious patients.
- It is also used in patients with post operative urinary retention and non ambulatory patients with multiple fractures.

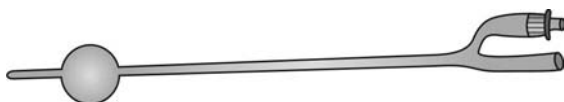


Fig. 5.83: Catheter

Tracheostomy Tube

- The tube may be made of metal or porthex. The tracheostomy tube has an inner and an outer tube. The curvature of the tube is such that it does not damage the trachea.
- Its main function is to allow air entry through a tracheostomy wound.

Alar Retractor (Fig. 5.84)

- It is used for the retraction of the ala of the nose during rhinoplasty

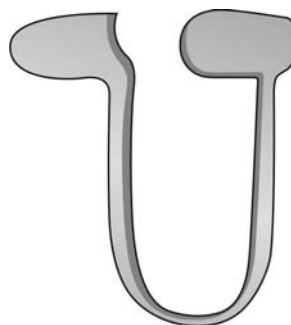


Fig. 5.84: Alar retractor

Suture Materials

- These are natural or synthetic materials used for suturing of tissues after any procedure or trauma.

Ideal Properties of a Suture Material

- Adequate strength
- Minimal reaction
- Easy handling
- Good knotting
- Good memory

Classification of Suture Material

1. Absorbable
 - i. Natural
 - catgut
 - collagen tape
 - tensor fascia lata
 - ii. Synthetic
 - dextran
 - vicryl
 - PDC
2. Non absorbable
 - i. Natural
 - linen
 - cotton
 - silk

ii. Synthetic

- Nylon
- Dacron
- Prolene

CATGUT

It is a natural absorbable suture material derived from sheep intestine submucosa. The name catgut is derived from an Arabic word- 'KINGUT' which is a thing used for whipping animal and is acquired via same method as catgut.

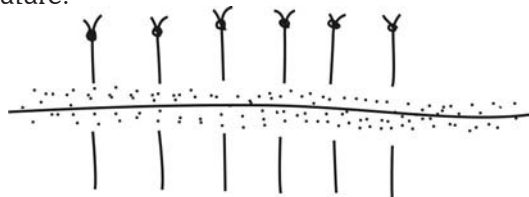
Catgut is a multifilamentous suture material, twisted mechanically and polished to make it appear monofilamentous. The material is numbered from 3-0 to 7-0 depending on its thickness. 3-0 is the thickest and 7-0 is the thinnest.

- 3-0 and 4-0, used for intraoral suturing
- 5-0 and 6-0, used for extraoral suturing

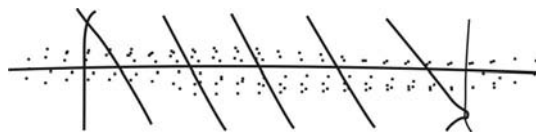
Catgut is absorbed by proteolytic degradation and phagocytosis in about 5-7 days (which can be altered by manufactures). Plain catgut has poor knot properties and poor tensile strength, thus Chromic catgut (made by addition of chromium salt at time of manufacturing) is used to increase its tensile strength and knot properties. It also prolongs absorption time and reduces tissue reaction. Catgut is stored in isopropyl alcohol which is a storage media and also softens it. Before using the catgut, it should be washed thoroughly with saline water to prevent from causing irritation.

Types of Suturing Used in Dentistry

Interrupted suture- earliest and mostly used. Can be used in areas of infection and loosening of one suture does not produce loosening of other suture.



Continuous suture- rapid water tight closure of areas is there and tension is uniformly distributed over the suture.



Continuous locking suture- locking prevents tightening of suture as wound closure progresses.

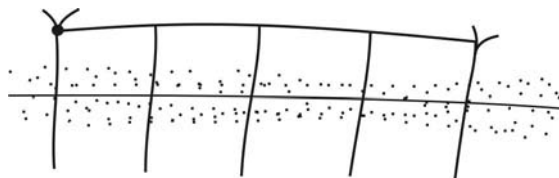
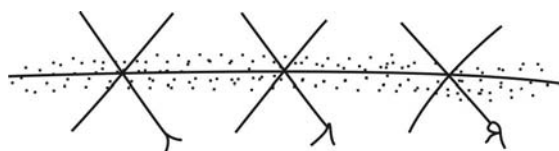
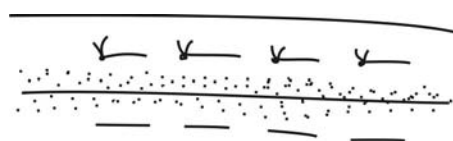


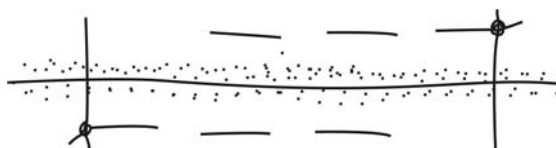
Figure of '8' suture-used for closure of extracted socket and adaptation of the gingival papilla around the tooth



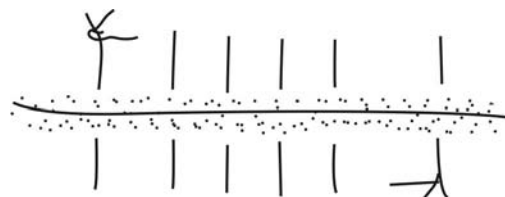
Horizontal mattress suture-



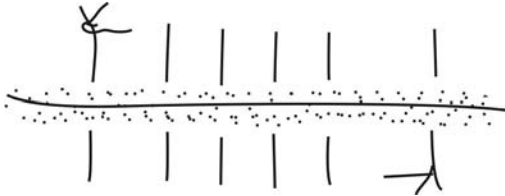
Continuous horizontal mattress suture-



Vertical mattress suture- done to close deep wounds.



Continuous vertical mattress suture-



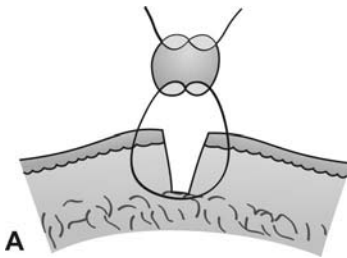
Subcuticular suture-

Anchor suture-

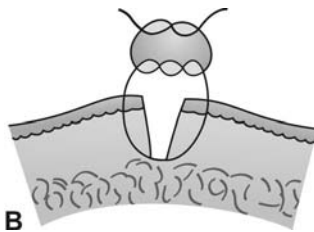
Continuous independent suture-

Types of Knot Used (Figs 5.85A to C)

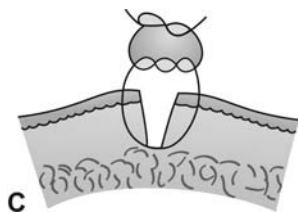
Square knot



Surgeon's knot

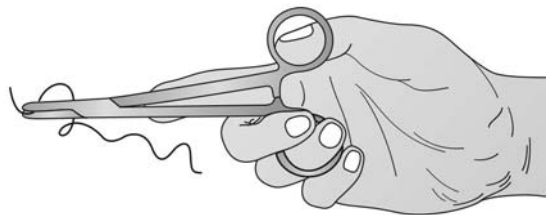


Granny's knot

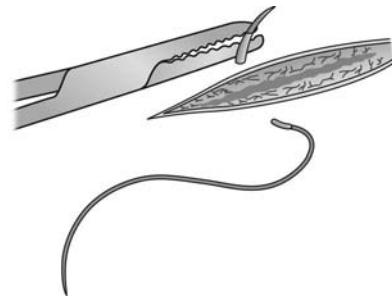


Principles of Suturing

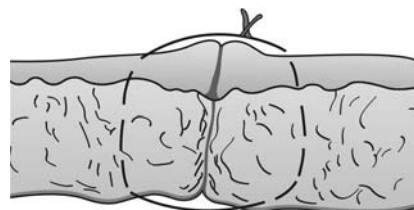
1. The needle holder should grasp the needle at approximately three-fourth of the distance from the point.
2. The needle should enter the tissue perpendicular to the surface.
3. The needle should be passed through the tissue following the curve of the needle.
4. The suture should be placed at an equal distance (2 to 3 mm) from the incision on both sides and at an equal depth.
5. If one tissue side is free and other fixed, the needle should be passed from the free to the fixed side.



Position of holding needle and method of holding forceps



Insertion of needle along with curvature



Position of knot-at the side

6. If one tissue side is thinner than the other, the needle should be passed from the thinner to the thicker side.
7. If one tissue plan is deeper than the other, the needle should be passed from the deeper to the superficial side.
8. The distance that the needle is passed into the tissue should be greater than the distance from the tissue edge.
9. The tissue should not be closed under tension, since they will either tear or necrose around the suture.
10. The suture should be tied so the tissue is merely approximated not blanched.
11. The knot should not be placed over the incision line.
12. Sutures should be placed approximately 3 to 4 mm apart.
13. Extra tissue should be excised to prevent 'Dog Ear' formation and other unsatisfactory results.

FURTHER READING

1. Archer WH — Oral and maxillofacial surgery, 5th ed. Vol. 1.
2. Danial M Laskin — Oral and maxillofacial surgery. The biomedical and clinical basis for surgical practice, Vol. 1.
3. GR Seward, M Harris, DA Mc Gown — Killey and Kay's outline of oral surgery, Part I, 10th ed.
4. Gustov O Kruger — Textbook of oral and maxillofacial surgery, 6th ed.
5. Peterson, Ellis, Hupp, Tucker — Contemporary oral and maxillofacial surgery, 4th ed, 2006.

Anesthesia in Oral and Maxillofacial Surgery

6

Anesthesia is the loss of feeling or sensation in a part of or all of the body. Anesthesia may occur as a result of injury to or disease of a nerve, but the term anesthesia is mostly applied to the technique of reducing or abolishing an individual's sensation of pain to enable surgery to be performed. This is affected by administering drugs (local anesthesia or general anesthesia) or by the use of other methods like, acupuncture or hypnosis. To understand about these procedures one has to briefly understand about the cause and physiology of pain.

GENERAL NERVE PHYSIOLOGY

The neuron is made up of three parts (Fig. 6.1):

1. Nerve cell body
2. Dendrite and
3. Axon.

Nerve Cell Body

The nerve cell body is irregular in shape and, like any other cell it is constituted by a mass of cytoplasm called as neuroplasm covered by a cell membrane. The cytoplasm contains a large nucleus, Nissl's granules/bodies, neurofibrils, mitochondria and Golgi apparatus.

Dendrite

The dendrites are the branched processes of the neuron and are branched repeatedly. The dendrites have Nissl granules and neurofibrils.

Dendrites are conductive in nature and, transmit impulses towards the nerve cell body. The dendrites are shorter processes terminating mostly near the nerve cell body.

Axon

The axon is the longest process of the nerve cell. This arises from axon hillock of the nerve cell body and is devoid of Nissl granules. The axon may extend for a long distance away from the nerve cell body. The length of the longest axon is about one meter.

Nerve fibres are of two kinds:

1. *Non-myelinated nerve fibres*: In these fibres the axis cylinder is covered by a membrane called neurolemma. The speed of nerve impulse conduction in these fibres is less.
2. *Myelinated nerve fibres (Fig 6.1)*: In these fibres the axis cylinder is covered by a thick sheath called myelin sheath which is in turn covered by neurolemma. The speed of nerve impulse conduction in these fibres are more due to the saltatory (jumping) type of conduction occurring in them.

IMPULSE CONDUCTION IN A NERVE FIBRE

The nerve fibres are present at resting state before any impulse reaches it. On getting excited by an impulse they change to depolarized state which further changes to repolarised state and than back to the resting state.

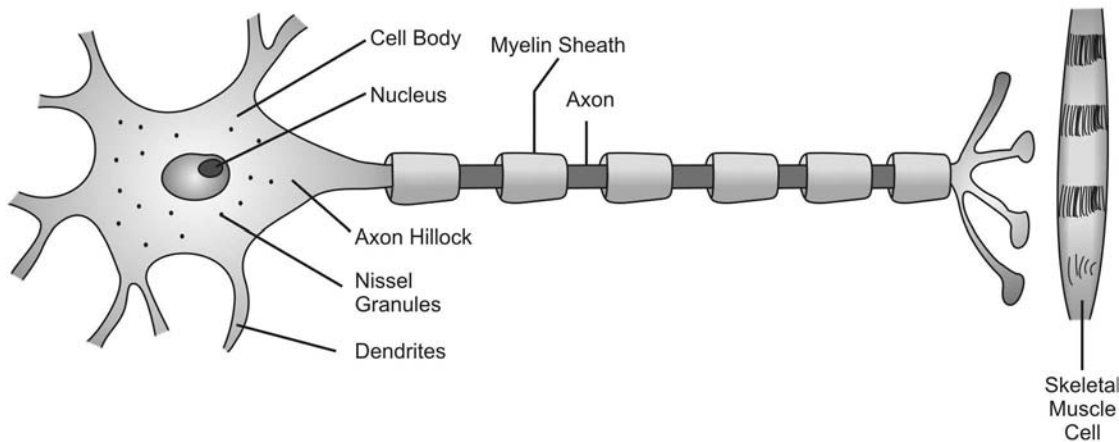


Fig. 6.1: Neuron (Myelinated nerve fibre)

Resting State

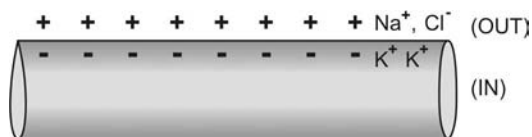


Fig. 6.2

During resting state the membrane is permeable to K^+ ions and impermeable to Na^+ ions. This change of permeability causes a potential difference across the membrane of -70 mV to -90 mV. (Resting potential) (Fig. 6.2).

Depolarised State

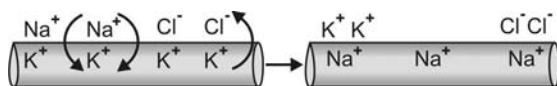


Fig. 6.3

As any impulse reach the nerve membrane, the acetylcholine neurotransmitter displaces Ca^{2+} ions from the phospholipid bimembrane, thus making membrane freely permeable to Na^+ ions without altering K^+ ions permeability. This alters the membrane potential which is transmitted through the nerve along the whole length in non-myelinated nerves and along the nodes in jumping manner in myelinated nerves (saltatory conduction) (Fig. 6.3).

Repolarised State

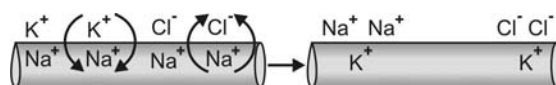


Fig. 6.4

After the impulse is transmitted to the adjacent neuron, the Ca^{2+} ions return back and membrane returns to its original state by K^+ ions moving in and Na^+ ion moving out actively. At the time of depolarization no new impulse transmission can occur, this is called absolute refractory period. Whereas the time during which repolarisation is occurring only impulse with stronger, potential can be transmitted, this is called relative refractory period (Fig. 6.4).

All or None Law

This law states that in any nerve fibre impulse can either be transmitted or not transmitted, the strength of the impulse determines the number of nerve fibres getting depolarized, as threshold potential gets crossed for more number of fibres.

Pain

It is an unpleasant emotional experience usually initiated by a noxious stimulus and transmitted

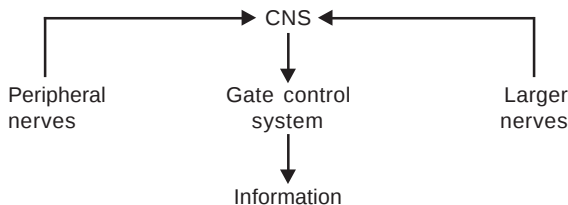
over a specialized neural network to the CNS where it is interpreted as such.

Pain has dual nature:

1. *Pain perception*: It is a physio-anatomic process where impulse is generated as transmitted.
2. *Pain reaction*: It is a psycho-physiological process where individual feels and senses pain.

Pain Theories

1. *Specific theory*: Specific mediator of touch, heat, cold and pain are present on skin and from here specific sensory nerve takes the impulse to specific site or pain centre in the brain where it is interpreted.
2. *Pattern theory*: Pain is dependent upon specific pattern of nerve impulse produced by summation of sensory input within spinal cord.
3. *Gate control theory*: Peripheral nerves carry impulse from skin to CNS, larger nerves also help in exciting or inhibiting the impulse. Descending control system modulates the excitation of cells and tissues and thus transmitted information about injury.



Pathways of Pain

The afferent fibres of trigeminal nerve bring impulses from the orofacial region. (tooth and adjacent structures) to the semilunar ganglion. From here the sensory fibres carry impulses to the pons, where the fibres divide into ascending (carry touch and pressure sign) and descending (carry pain signs) (Fig. 6.5).

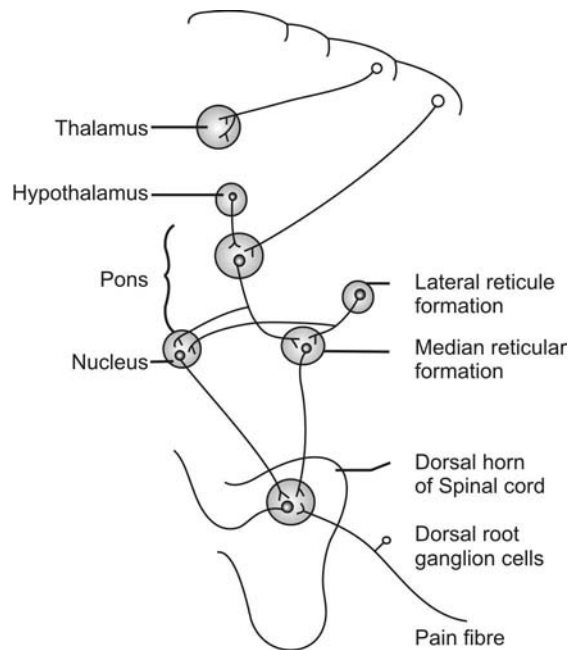
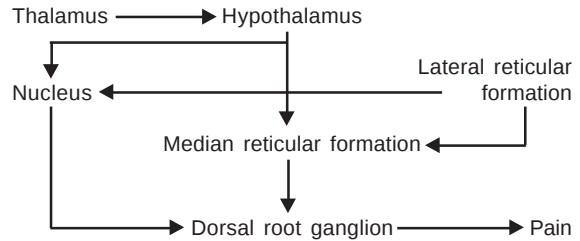


Fig. 6.5: Descending tract of fibres (transmission of pain in CNS)

FACIAL NERVE NEUROLOGY

Course of the Facial Nerve

The facial nerve is attached to the brainstem by two roots- motor and sensory (nervous intermedius). The two roots are attached to lower part of the lateral border of the pons just medial to the VIII cranial nerve and then reach the internal acoustic meatus.

In the meatus, the motor root lies in the groove of the VIII cranial nerve, with the sensory

root intervening them. Here the VII and VIII cranial nerves are accompanied by the labyrinth vessels.

Within the canal, the course of the nerve is divided into three parts by two bends:-

1st part—just above the vestibule

2nd part—near middle ear, above the promontory

3rd part—behind the promontory

The first bend is sharp; near the anterosuperior part of the promontory also called the Genu and contains the geniculate ganglion.

The second bend is gradual and lies in between the promontory and aditus of the ear.

The facial nerve leaves the skull through the stylomastoid foramen. In its extracranial course, the facial nerve crosses the base of the styloid process and enters the parotid gland. It then crosses the retromandibular vein and external carotid artery and behind the neck of the mandible it divides into five terminal branches which emerge along the parotid gland.

Branches of the Facial Nerve

I. *Within the facial canal:*

- i. Greater petrosal nerve (supplies the lacrimal gland and the mucosal glands of nose, palate, pharynx)
- ii. Nerve to the stapedius (supplies the stapedius muscle)
- iii. Chorda tympani (supplies the submandibular and sublingual glands, and taste buds of anterior 2/3 of tongue)

II. *Extracranial:*

- i. Posterior auricular nerve (supplies the auricularis and occipitalis)
- ii. Digastric nerve (supplies posterior belly of digastric muscle)
- iii. Stylohyoid nerve (supplies stylohyoid muscle).

III. Terminal branches in the parotid gland:

- i. Temporal nerve (supplies the auricularis, frontalis, orbicularis oculi)
- ii. Zygomatic nerve (supplies the orbicularis oculi)
- iii. Buccal nerve (the upper buccal nerve supplies the parotid duct).
- iv. Mandibular nerve (supplies muscles of lower lip and chin)
- v. Cervical nerve (supplies the platysma)

Trigeminal Nerve Neurology

It is the largest cranial nerve contains both sensory and motor fibres. It is the sensory nerve of the face (Fig. 6.6).

Sensory Root

It arises from the semilunar ganglion. The ganglion forms two processes—Central and Peripheral. The peripheral branches to form ophthalmic, maxillary and mandibular division of the trigeminal nerve. The central branches are the sensory roots of the trigeminal nerve.

Motor Root

This consists of fibres that arise in the motor nucleus located in the pons. The filament passes from the pons along the medial side of semilunar ganglion and passes below the foramen ovale and joins the mandibular division of sensory root. It supplies the muscles of mastication, therefore called as masticator nerve.

Mesencephalic Root

They accompany the fibres of motor root.

Branches of the Trigeminal Nerve

A. *Ophthalmic division*

1. Lacrimal nerve (supplies the lacrimal gland and conjunctiva).

2. Frontal nerve (supplies the frontal sinus)
 - a. Supraorbital nerve (supplies the upper eyelid, scalp and forehead)
 - b. Supratrochlear nerve (supplies the skin of the upper eyelid, median portion of forehead).
 3. Nasociliary nerve
 - a. Branches in the nasal cavity
 - b. Branches in the face
 - c. Branches in the orbit:
 - i. Long ciliary nerve (supplies the iris and cornea)
 - ii. Posterior ethmoid nerve (supplies posterior ethmoidal sinus and sphenoidal sinus).
 - iii. Anterior ethmoid nerve (supplies anterior ethmoid sinus and frontal sinus).
 - Internal nasal nerve
 - External nasal nerve (supplies the tip of nose, ala and vestibule).
- B. Maxillary division:*
1. In the middle cranial fossa - Middle meningeal nerve. (supplies the dura).
 2. In the pterygopalatine fossa -
 - a. Zygomatic nerve
 - i. Zygomatico temporal nerve (supplies the temporal fossa region).
 - ii. Zygomatico facial nerve (supplies zygomatic bone, upper lip, upper part of the cheek).
 - b. Pterygopalatine nerve
 - i. Orbital branches.
 - ii. Nasal branches
 - Posterior superior lateral nasal nerve
 - Medial nerve/nasopalatine nerve
 - iii. Palatine branches
 - Greater palatine branch (supplies hard palate and gingiva).
 - Middle palatine nerve (supplies mucous membrane of the soft palate).
 - c. Posterior superior alveolar nerve (supplies all the maxillary molars except for the mesiobuccal root of the maxillary 1st molar, also the upper gingiva and adjoining parts of the cheek).
 - d. Branches in the infraorbital groove:
 - i. Middle superior alveolar nerve (supplies the maxillary premolars)
 - ii. Anterior superior alveolar nerve (supplies the incisor and canine teeth).
 - e. Terminal branches on face:
 - i. Palpebral branch (supplies skin of lower eyelid).
 - ii. Nasal branches (supplies the skin of the side of nose and nasal septum).
 - iii. Superior labial branch (supplies the skin of anterior part of cheek, skin of upper lip, labial glands and mucous membrane of mouth).
- C. Mandibular Division*
1. Branches from the autonomic ganglia associated-
 - a. Submandibular ganglion
 - b. Otic ganglion
 2. Branches from the undivided nerve (main trunk)-
 - a. Nervous spinosus (supplies the dura and the mastoid cells).
 - b. Nerve to medial pterygoid (supplies medial pterygoid, tensor tympani and tensor veli palatine)
 3. Branches from the divided nerve-
 - a. From Anterior division:
 - i. Nerve to lateral pterygoid (supplies lateral pterygoid muscle).
 - ii. Buccal nerve (supplies buccinator, buccal gingival of lower molars).
 - iii. Deep temporal nerve (supplies lateral pterygoid and temporalis)
 - iv. Masseteric nerve (supplies the TMJ).
 - b. From posterior Division:
 - i. Auriculotemporal nerve (supplies TMJ, skin of tragus, meatus and tympanic membrane).

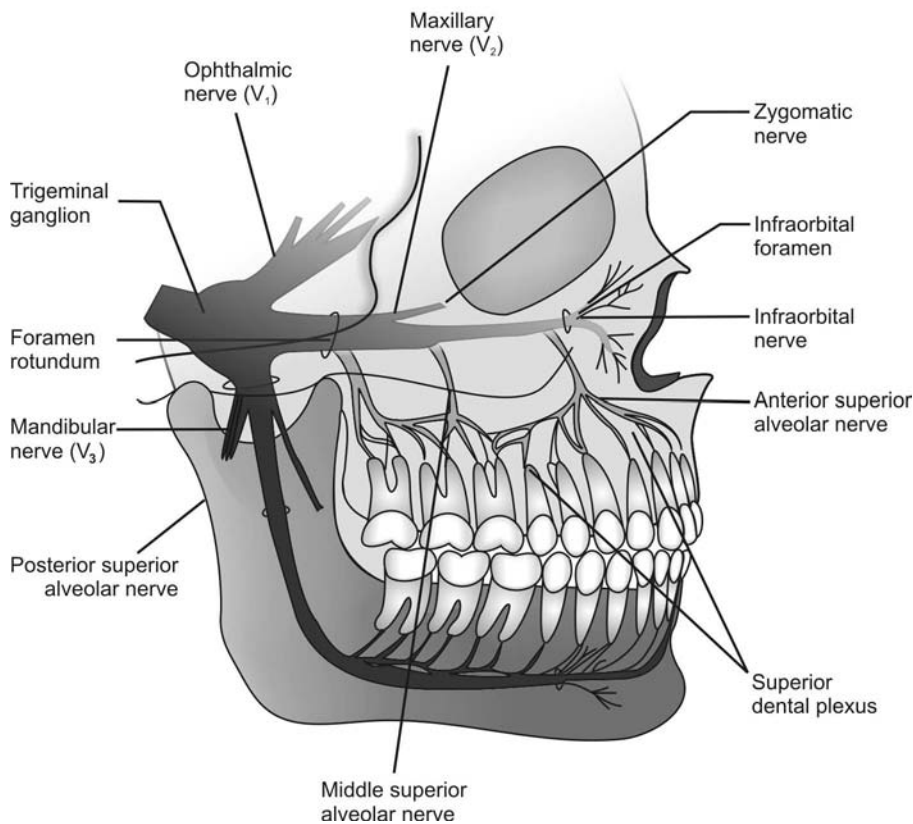


Fig. 6.6: Branches of trigeminal nerve

- ii. Lingual nerve (supplies mucous membrane of floor of mouth, gingiva on lingual surface of mandible, and bicuspid and 1st molar).
- iii. Inferior Alveolar nerve (supplies all the mandibular teeth and also the gingiva anterior to the 1st molar).

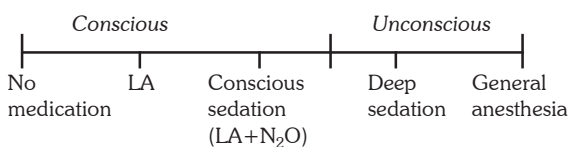
LOCAL ANESTHESIA

Local anesthesia is the loss of sensation in the circumscribed area of the body caused by depression of excitation in nerve ending or an inhibition of the conduction process in the peripheral nerves.

Theories of Local Anesthesia Action

1. *Acetylcholine theory*: Local anesthesia prevents acetylcholine at the synapse to alter the cell permeability, thus prevents depolarization. This theory is less accepted as acetylcholine is not always present at the synapse.

ANESTHETIC PROCEDURES USED IN DENTISTRY



2. *Calcium displacement theory*: Local anesthesia blocks calcium channel and prevents the displacement of calcium needed for depolarization. This theory is less accepted as even in the abundance of calcium around local anesthesia acts well.
 3. *Surface charge theory*: Local anesthesia is positively charged and it binds to the outer surface of nerve membrane, thus hindering the depolarization process. This theory is less accepted as neutral local anesthesia also acts well.
 4. *Membrane expansion theory*: Local anesthesia solution is hydrophobic and it easily diffuses into the nerve membrane, thus altering the nerve membrane permeability. It also blocks the sodium channel inhibiting depolarization. This theory best explains about benzocaine- neutral local anesthetic solution.
 5. *Specific receptor hypothesis*: Local anesthesia solution attaches itself to specific receptors present at the external or internal surface of nerve membrane and generally near the Na^+ channel. This blocks the sodium channel and inhibits depolarization. This theory is best accepted as receptors are found present by chemical and electrophysiological studies.
 - iv. Increased amount of local anesthetic agent remain in and around the nerve for longer duration, thus increasing the action of local anesthesia.
 - v. There is decreased bleeding at the site of administration.
Other effects of vasoconstrictor are:
 - vi. Makes the injection more painful
 - vii. Increases the chances of subsequent local tissue edema, necrosis and delayed wound healing.
 - viii. Raising the B.P. and promoting arrhythmia in susceptible individuals.
- A local anesthetic solution with 1:1, 00,000 adrenaline contains 0.01 mg/ml of adrenaline.
3. *Reducing Agent*: Sodium metabisulphite- 0.5 mg/ml
This agent reacts with oxygen before it destroys the vasoconstrictor concentration.
 4. *Preservative*: Methyl Paraben- 0.1 mg/ml
This is added to the solution to give a shelf life of 2 years or more.
Disadvantage is it causes allergic reactions.
 5. *Salt*: Sodium chloride- 0.9 percent
This is added to make the solution isotonic.
 6. *Distill water or Ringer lactate solution*: Added to give volume to the solution and acts as a vehicle.
 7. *Fungicide*: Thymol
It is added to provide antifungal properties.

COMPOSITION OF LOCAL ANESTHETIC SOLUTION

1. *Local anesthetic agent*: Lignocaine hydrochloride- 2 percent (20 mg/ml)
2. *Vasoconstrictor*: Adrenaline- 1:80,000 to 1:2,00,000

Functions of Vasoconstrictor

- i. By constricting the blood vessels it decreases the blood flow to the site of administration.
- ii. Absorption of local anesthesia into the C.V.S is slowed down thereby resulting in lower anesthetic blood level.
- iii. The lower anesthetic blood level decreases the risk of L.A toxicity.

CLASSIFICATION OF LOCAL ANESTHETIC AGENT

I. According to Chemical Structure

1. *Esters*:
 - a. Esters of Benzoic acid
 - Butacaine
 - Cocaine
 - Hexylcaine
 - Piperacaine
 - Tetracaine
 - Benzocaine

- b. Esters of Para amino Benzoic acid:-
 - Chloroprocaine
 - Propoxycaine
 - Procaine

2. *Amides:*

- Articaine
- Bupivacaine
- Lidocaine
- Etidocaine
- Mepivacaine
- Prilocaine

3. *Quinolones:*

- Centbucridine.

II. According to Solubility (duration of action and potency)

a. *Injectable:*

- i. Low potency, short duration of action-
 - Procaine
 - Chloroprocaine
- ii. Intermediate potency and intermediate duration of action-
 - Lidocaine
 - Prilocaine
- iii. High potency and long duration of action-
 - Bupivacaine
 - Tetracaine
 - Debucaïne
 - Ropivacaine

b. *Surface Anesthetics:*

- i. Soluble
 - Cocaine
 - Lidocaine
 - Tetracaine
- ii. Insoluble
 - Benzocaine
 - Butylamino-beuzoate
 - Oxethazine

III. According to Biological Site and Mode of Action

1. Class A (action on external surface of nerve membrane).
 - Biotoxins (tetrodotoxin and saxitoxin)

2. Class B (action on internal surface of nerve membrane)
 - Quarternary ammonium analogues of lidocaine.
 - Scorpion venom.
3. Class C (acting by a receptor - independent physiochemical mechanism).
 - Benzocaine
4. Class D (acting by combination of receptor and receptor - independent mechanisms).
 - Most clinically useful local anesthetic agents, for example
 - Articaine
 - Lidocaine
 - Mepivacaine
 - Prilocaine

PHARMACOKINETIC OF LOCAL ANESTHETIC SOLUTION

Esters are hydrolysed by esterase present in plasma and the liver. Amides are metabolized in the liver by N-dealkylation. Action is terminated by removal from the site of application into systemic circulation.

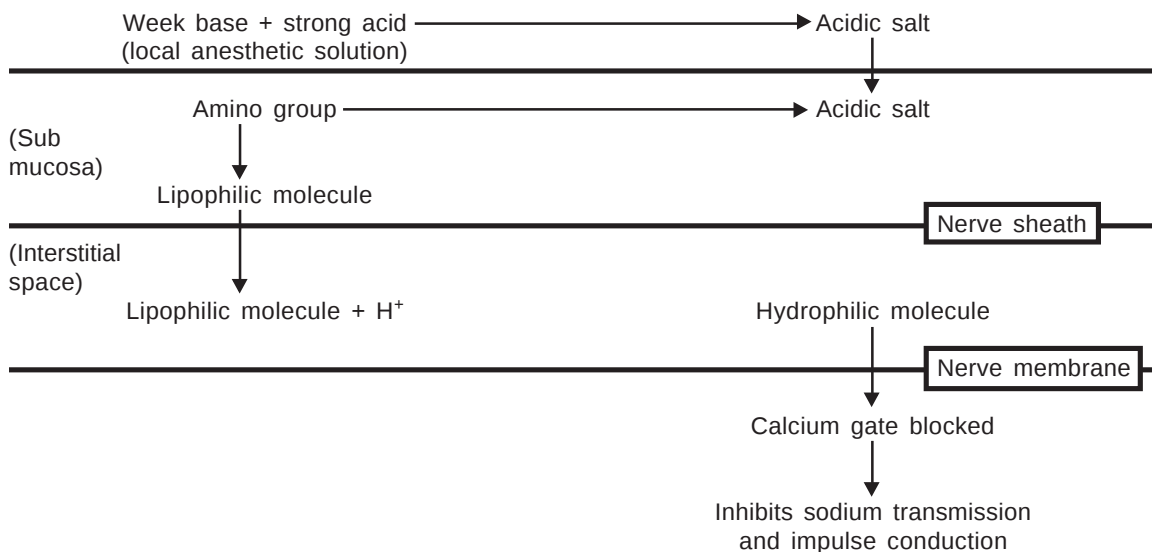
REQUISITION OF AN IDEAL LOCAL ANESTHETIC SOLUTION

An ideal local anesthetic solution should have:

1. Rapid onset of action.
2. Long acting.
3. Local constrictor effect
4. No local/systemic toxicity
5. No allergic reactions
6. Economical
7. Reversible action.
8. Safe.
9. Compatible PH to local tissues.
10. Easy sterilizable without losing its potency and shelf life.

MECHANISM OF ACTION OF LOCAL ANESTHETIC SOLUTION

Local anesthetic solution blocks voltage-gated channel in a use or frequency dependent manner.



Local anesthesia interferes with excitation process in one of the following ways-

- Altering the basic resting potential of the nerve membrane
- Altering the threshold potential
- Decreasing the rate of depolarisation
- Prolonging the rate of repolarisation

EFFECT OF LOCAL ANESTHETIC SOLUTION

1. On CNS = First produces stimulation and then depression. Convulsion may occur due to depression of inhibitory areas.
2. On CVS = It varies in accordance with dose. In dose of 50-100 mg used to correct ventricular arrhythmias and in moderately large dose it causes decrease in myocardium excitability (negative inotropic effect).

Loss of function occurs in the following order:-

- Autonomic function
- Pain
- Cold
- Warmth
- Touch

- Deep pressure
- Proprioception
- Skeletal muscle tone and action.

INDICATIONS OF LOCAL ANESTHESIA IN DENTISTRY

1. Extraction of teeth.
2. Odontomy procedures.
3. Alveoplasty and other surgical procedures.
4. Deep cavity preparation
5. Pulpotomy and pulpectomy
6. Enucleation and marsupialization of cysts.
7. Relief of denture irritation.
8. Treatment of trismus
9. Neuralgias and facial pain management
10. During radiography in patients with gagging
11. Treatment of facial fractures.

CONTRAINDICATIONS OF LOCAL ANESTHESIA

1. Fearful and apprehensive patients
2. Allergic patients
3. In case of acute infections
4. Mentally retarded patients and uncooperative patients

5. Anatomical abnormalities
6. Hyperthyroidism patients
7. Patients with liver disorder
8. Patients with renal disorders
9. Patients with cardiac disorders
10. Diabetic patients
11. Patients undergoing major surgeries.

COMPLICATION OF LOCAL ANESTHETIC SOLUTION

I. Complication caused because of anesthetic solution:

1. Systemic Drug reactions:

- i. Toxicity: It is caused due to -
 - Large dose
 - * LA solution action can be reverted by phentolamine mesylate
 - High concentration
 - Direct route of administration (I.V)
 - Rapidity of injection
 - Rapid absorption
 - Retarded metabolism (due to liver defect)
 - Retarded excretion (due to kidney defect)

Effects that are caused due to toxicity are mainly on the central nervous system. Here excitation is there followed by depression:

- Cerebral excitation
 - Restlessness
 - Talkativeness
 - Excitement
 - Convulsion
- Medullary excitation
 - Increase in B.P
 - Increase pulse
 - Increase respiratory rate
 - Nausea and vomiting.
- Cerebral depression
 - Lethargy
 - Sleepiness
 - Unconsciousness
- Medullary depression
 - Decrease in B.P

- Decrease pulse rate
- Decrease respiratory rate.

Other effects are Cardiac Depression and Respiratory Depression.

Preventions are:

- Aspirate before injecting
- Small dose injection
- Use of vasoconstrictor (if not contraindicated)
- Slow injection
- Weak strength used.

Treatments are:

- For mild case, no treatment is required only discontinue drug.
- For moderate cases, I.V Diazepam or Phenobarbitol sodium and oxygen inhalation is given
- For convulsion, I.V Succinylcholine and oxygen ventilation is given.
- Cardiovascular and respiratory support given.
- ii. *Idiosyncrasy*: It is a potential, fatal response to the drug which depends on patients psychology and underlying pathology.
- iii. *Allergy*: It is caused due to antigen antibody reaction in patient previously sensitized to the drug.

Effects:

- Rashes, urticaria
- Angioneurotic edema
- Rhinitis
- Asthmatic symptoms

Treatment:

- Pre anesthetic evaluation should be done.
- Antihistamines administered.
- Epinephrine inhaler
- Aminophylline given
- Oxygen inhalation given

- iv. *Anaphylactic Reactions*: Similar to management of Hypersensitive patient as discussed earlier.

2. Local drug Reactions:

- i. Infections by contaminated solutions
- ii. Local irritations caused by solution.

II. Complications caused because of needle insertion problem:

1. Syncope - Discussed earlier.
2. Muscle trismus - It heals upon itself by time.
3. Pain - to avoid pain use sharp needle with proper technique. (infiltration should be given paraperiosteally not subperiosteally)
4. Edema- It is caused due to trauma infection, allergy, hemorrhage.
To prevent proper care should be taken.
5. Infections- Proper care and Antibiotics should be taken.
6. Broken needle- It can be caused due to :
 - i. Primary - because of unexpected patient movement
 - ii. Secondary- because of size of needle, redirecting needle in tissue or manufacturing defect.
7. *Prolonged Anesthesia*: It is caused due to contamination of local anesthesia with cold solution, alcohol or other sterilizing media and also because of nerve impingement.
8. *Hematoma*: It is caused because of improper technique leading to blood vessel injury or coagulation diseases. No treatment is required as it heals in 2-3 days on itself. (symptomatic relief)
9. *Sloughing*: Sloughing of tissues takes place because of improper technique and use of large amount of local anesthesia.
10. *Bizzare neurological symptoms like*:
 - Facial palsy
 - Muscular weakness
 - Temporal blindness
 - Crossed eye.

Most common complications in maxillary nerve blocks are:

- i. Hematoma
- ii. Patient discomfort and pain
- iii. Necrosis and ischemia of soft tissues

Most common complication is mandibular nerve blocks are:

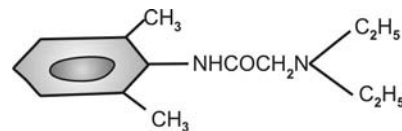
- i. Muscle trismus

- ii. Hematoma
- iii. Facial palsy

LIGNOCAINE HYDROCHLORIDE AS LOCAL ANESTHETIC AGENT

It is the most commonly used local anesthetic agent in dental practice. It represents the gold standard to which all new local anesthetics are compared.

- Chemical formula =



- Potency = 2 (in compared to procaine)
- Toxicity = 2 (in compared to procaine)
- PKa = 7.9
- pH of plain solution = 6.5
- pH with vasoconstrictor = 5.0-5.5
- Onset of action = rapid, 2-3 minutes
- Effective half life = 90 minutes.
- Safety parameter in pregnancy = B (can be used but some complication is noted)
- Safety parameter in lactation = S (safe to use)
- Pharmacokinetics = Metabolised in liver by microsomal fixed- functional oxidases, converted to monoethylglycerine and xylylde which is potentially toxic. Excreted via the kidney less than 10 percent unchanged and more than 80 percent as metabolites.
- Maximum recommended dose = 3.2 mg/lb or 7.0 mg /kg body weight (with vaso-constrictors) - less than 500 mg and, 2.0 mg/lb or 4.4 mg/kg body weight (without vasoconstrictors)- less than 500 mg.
- Formulations used for dental practice =
 1. 2 percent lignocaine without vaso-constrictor. (lignocaine plain)
 - Provides 5-10 minutes of pulpal anesthesia.
 - Increased adverse reactions seen.

2. 2 percent lignocaine with 1: 50,000 adrenaline
 - Provides 60 minutes of pulpal and 3-5 hours of soft tissue anesthesia.
 - It is used mainly for hemostasis purpose in surgery and with care in patients with CVS and hypothyroid diseases.
3. Two percent lignocaine with 1:1, 00,000 adrenaline
 - Provides 60 minutes of pulpal and 3-5 hours of soft tissue anesthesia.
 - It is used for most dental procedures.
4. EMLA (Eutectic mixture of local anesthesia)-
 - It is a mixture of lignocaine and prilocaine formed into an ointment
 - It is applied 60 minutes prior to insertion of canula, needle, anesthetizing intact skin or under occlusive dressing.

TECHNIQUE USED FOR ANESTHESIA IN DENTISTRY

1. *Topical or surface anesthesia:* Here, anesthesia solution is applied topically to the free nerve endings thus making it incapable to create impulses. It is available in form of solution, gel, or ointment. Lignocaine, Benzocaine and amethocaine are widely used.
2. *Infiltration anesthesia:* Here, the small terminal nerve endings are flooded by local anesthesia solution, making the area insensible to stimulus. Lignocaine, bupivocaine, and procaine are widely used.
3. *Field block:* Here, anesthetic solution is deposited in close proximity to the large terminal nerve branch. Afferent impulses are blocked from traveling forward and area is anesthetized.
4. *Nerve block:* Here, anesthetic solution is deposited in close proximity to the main trunk of nerve. Afferent impulses are blocked from traveling forward and area is anesthetized. Nerve block can be of following kinds-subperiosteal, supraperiosteal, intraosseous, intraseptal, intrapulpal and intraligamentary.
5. *Epidural anesthesia:* Here, anesthetic solution is deposited in epidural space (between bone and dura mater). This technique is rarely used in dental practice.
6. *Spinal anesthesia:* Here, anesthesia solution is deposited into the subarachnoid space. Lignocaine, amethocaine and procaine are widely used.

PROPERTIES OF SOME INDIVIDUAL LOCAL ANESTHETIC AGENTS

Drug	Onset of action (minutes)	Duration of action (hours)	Tissue penetration	Metabolism	Uses
1. Lignocaine (Amide)	2-3	1	Good	Dealkylation in liver	Mostly used
2. Bupivocaine (Amide)	10	3-9	Moderate	Dealkylation in liver	– Nerve block – Endural anesthesia – Reduce post-op pain
3. Prilocaine (Amide)	2-5	2	Moderate	Dealkylation in liver	– Regional anesthesia – Infiltration
4. Amethocaine (Ester)	10	3	Moderate	Plasma, liver hydrolysis by esterase	– Topical anesthesia for eye and throat
5. Procaine (Ester)	2-6	2-3	Poor	Plasma, liver hydrolysis by esterase	– Rarely used now, first used anesthesia.

Local infiltration and field block are same methods and technique with only difference in the site of injection. In field block the instrumentation is used peripherally to the site of injection and in local infiltration the instrumentation is in the same area as the injection.

The various methods of field block and local infiltration are:

1. Sub mucosal injection- the needle is inserted into the tissue underlying the mucous membrane and the local anesthetic diffuses in this plane.
2. Para periosteal injection- the needle penetration is continued until contact is made

with the periosteum. The anesthetic solution is deposited so that it diffuses along side of and through the periosteum.

3. Intra osseous injection- this method is utilized when other methods fail to produce adequate analgesia. The anesthetic solution is deposited directly into the cancellous bone.
4. Inter septal injection- in this method the needle is inserted into the thin porous interseptal bone on either side of the tooth to be anesthetized.
5. Inter ligamentary injection- the needle is inserted into the periodontal ligament at the mesio buccal corner of the mouth.

VARIOUS NERVE BLOCKS USED IN DENTAL PRACTICE

I. Procedures used for nerve blocks in maxilla:

Name	Nerves Anestheised	Areas Anesthetised	Land Marks	Technique	Symptoms
1. Infra-orbital nerve block (Fig. 6.8)	-Infraorbital -Anterior superior alveolar -Middle superior alveolar. -Infra-palpebral -Lateral nasal -Superior labial.	-Incisors, cuspid and bicuspid, -mesial root of first molar -Bony and soft tissue support. -Upper lip. -Lower eyelid. -Portion of nose.	-Infraorbital ridge -Infraorbital depression -Supraorbital notch -Anterior teeth -Pupils of eye	-Needle is inserted either via bicuspid approach or via central incisor approach to infraorbitor canal where solution is deposited.	-Tingling and numbness of upper lip, lower eye lid and side of nose. (subjective) -Absence of pain, sensation on instrumentation (objective)
2. Zygomatic or posterior superior alveolar nerve block or tuberosity block or PSA nerve block (Fig. 6.7)	-Posterior superior alveolar nerve.	-Maxillary molars (except mesiobuccal root of first molar) -Buccal alveolar process of upper molars -Adjacent structures	-Mucobuccal fold -zygomatic process of maxilla -Infratemporal surface of maxilla -Anterior border and coronoid process of ramus -Maxillary tuberosity	-Needle is inserted via the mucosa and buccal pad of premolar to reach the posterior area, posterior to maxilla.	-No subjective symptoms -Absence of pain sensation on instrumentation (objective)

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Name	Nerves Anestheised	Areas Anesthetised	Land Marks	Technique	Symptoms
3. Naso-palatine nerve block	-Nasopalatine nerve.	-Anterior portion of hard palate -Associated structures	-Central incisors -Incisive papilla in the midline of palate.	-After a preparatory injection, the needle is inserted at right angle to labial plate near the crest of the papilla.	-Numbness felt on palate (subjective) -Absence of pain sensation on instrumentation (objective)
4. Anterior palatine nerve block or greater palatine nerve block.	-Anterior palatine nerve	-Posterior portion of hard palate -Associated structures	-Second and third maxillary molars -Midline of palate -A line 1 cm from palatal gingival margin to midline of palate.	-Needle is inserted between second and third molars about 1 cm from palatal gingival margin towards the midline.	-Numbness felt on posterior palate (subjective) -Absence of pain sensation on instrumentation (objective)
5. Maxillary nerve block.	-Maxillary nerve	-Maxillary teeth -Associated structures -hard and soft palate -upper lip, cheek, side of nose and lower eyelid	-In case of high tuberosity technique all landmarks are same as PSA nerve block. -In case of greater palatine canal technique all landmarks are same as anterior palatine nerve block.	-Either similar to PSA nerve block or Anterior palatine nerve block.	Tingling and numbness of upper lip, lower eye lid and side of nose. (subjective) -Absence of pain sensation on instrumentation (objective)
6. Infra-orbital nerve block (extraoral technique) (Fig. 6.9)	-Same as in intraoral technique	-Same as in intraoral technique	-Pupil of eye- Infraorbital ridge -Infraorbital notch -Infraorbital depression	-Needle is inserted till the infraorbital foramen palpated from extraoral landmarks and care should be taken for the facial artery and vein present.	-Same as in intraoral technique
7. Maxillary nerve block (extraoral technique)	-Same as in intraoral technique	-Same as in intraoral technique	-Midpoint of zygomatic arch -Zygomatic notch. -Coronoid process of mandible -Lateral pterygoid plate.	-Needle is inserted till 4.5 cm at the midpoint of zygomatic process near the depression till pterygoid plate is contacted and than the needle is pulled and reinserted till 4.5 cm in a slight forward and upward direction.	-Same as in intraoral technique

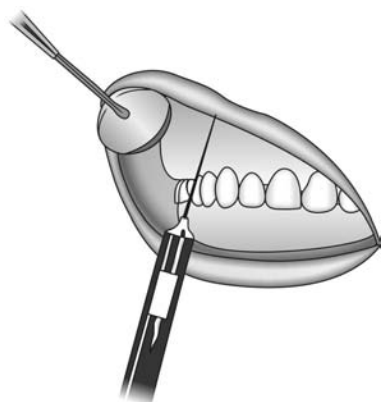


Fig. 6.7: Local infiltration and posterior superior alveolar nerve block



Fig. 6.8: Infraorbital nerve block



Fig. 6.9: Infraorbital nerve block

II. Procedures used for nerve blocks in mandible:

Name	Nerves Anesthetised	Areas Anesthetised	Land Marks	Technique	Symptoms
1. Classical inferior alveolar nerve block (Fig. 6.10)	-Inferior alveolar nerve -Mental nerve -Incisive nerve -Lingual nerve -Buccal nerve	-Body and inferior portion of ramus of mandible. -Mandibular teeth -Associated structures	-Mucobuccal fold -Anterior border of ramus -external oblique ridge -retromolar triangle -internal oblique ridge -pterygomandibular ligament -pterygomandibular raphae.	- After palpating the landmarks the needle is inserted parallel to occlusal plane of mandibular teeth and from opposite side of mouth at the level of bicuspid till it contacts bone.	-Tingling and numbness of lower lip and tongue -if lingual nerve is effected (subjective) -Absence of pain sensation on instrumentation (objective)
2. Mandibular nerve block (closed mouth approach) or Vazirani Akinosi technique (Fig. 6.11)	-Same as in classical inferior alveolar nerve technique	-Same as in classical inferior alveolar nerve technique	-occlusal plane of occluding teeth. - mucogingival junction of upper molar. -anterior border of ramus.	-needle is inserted with mouth closed, parallel to occlusal plane at level of mucogingival junction of maxillary molar to reach the medial surface of ramus.	-Same as in classical inferior alveolar nerve technique.
3. Mandibular nerve block - Gow Gates technique (Fig. 6.12)	-Same as in classical inferior alveolar nerve technique	-Same as in classical inferior alveolar nerve technique	-anterior border of ramus -tendon of temporalis -corner of mouth -intertragic notch of ear -external ear	-needle is inserted along a plane from corner of mouth to intertragic notch, lateral to pterygomandibular depression till it reaches to just inferior to condyle.	-Same as in classical inferior alveolar nerve technique.

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Name	Nerves Anestheised	Areas Anesthetised	Land Marks	Technique	Symptoms
4. Lingual nerve block	-Lingual nerve	-Anterior two third of tongue. -Floor of mouth -Associated structures	-Same as in classical inferior alveolar nerve block	-same as in inferior alveolar nerve block except that it is given from same side of mouth after retracting 1 mm of the needle.	-Tingling and numbness of anterior two-third of tongue. (subjective) - Absence of pain sensation on instrumentation (objective)
5. Long buccal nerve block	-Buccal nerve	-Buccal mucous membrane -Mucoperosteum of mandibular molar area.	-external oblique ridge -retromolar triangle	-needle is inserted into buccal mucosa just distal to third molar	-no symptoms (subjective) -absence of pain sensation on instrumentation (objective)
6. Mental and incisive nerve block	-Mental nerve -Incisive nerve	-Lower lip -mucous membrane near mental foramen -Incisor, cuspid and Bicuspid of lower arch	-mandible bicuspid	-needle is inserted into the mucobuccal fold near the second premolar	-Tingling and numbness of lower lip of side. (subjective) -absence of pain sensation on instrumentation (objective)
7. Mandibular nerve block (extraoral technique)	-Same as in classical inferior alveolar nerve block	-same as in classical inferior alveolar nerve block	-same as maxillary nerve block -extraoral technique	-same as maxillary nerve block extraoral technique except that needle is inserted for 5 cm and is redirected in upward and slight posterior direction.	-same as classical inferior alveolar nerve block
8. Mental and incisive nerve block (extraoral technique)	-Same as mental and incisive nerve block (intraoral technique)	-same as mental and incisive nerve block (intraoral technique)	-Bicuspid teeth -lower edge of body of mandible -supraorbital notch -infraorbital notch -pupil of eye.	-needle is inserted through a point coinciding the line drawn joining the supraorbital notch, pupil of eye and infraorbital notch and a midway point of lower border of mandible and gingival margin	-same as mental and incisive nerve block (intraoral technique)

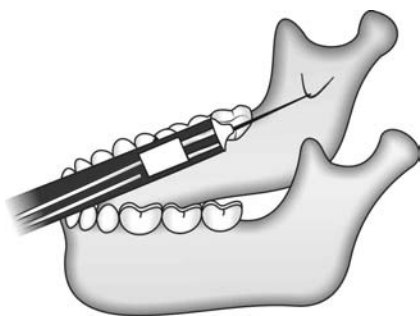


Fig. 6.10: Inferior alveolar block

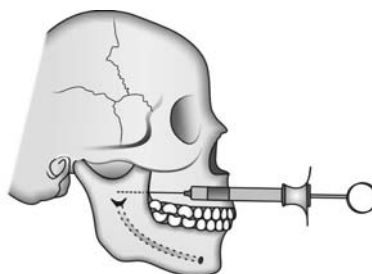


Fig. 6.11: Akinosi's technique



Fig. 6.12: Gow gates technique

USAGE OF VARIOUS LOCAL ANESTHESIA TECHNIQUES IN DENTISTRY

Site	A. Conversation	B. Extraction	C. Other treatment
Maxillary teeth			
1. Any one incisor	Labial infiltration of 1 ml.	As for (A) with palatal infiltration 0.25 ml.	For apicoectomy the infraorbital nerve block of 1.5 ml is recommended with palatal infiltration 0.25-0.5 ml.
2. All four incisor	Labial infiltration of 3 ml	As for (A) with long sphenopalatine nerve block 0.25 ml	
3. Canine	Labial infiltration of 1.5 ml	As for (A) with palatal infiltration 0.25 ml	
4. <u>123</u>	Labial infiltration of 3 ml or infraorbital nerve block 1.5 ml with labial infiltration of 1 ml over central incisors	As for (A) with palatal infiltration 0.5 ml	
5. Any one premolar	Buccal infiltration of 1 ml	As for (A) with palatal infiltration of 0.25 ml	
6. Any one molar	Buccal infiltration of 1 ml		
7. Two adjacent molars	Buccal infiltration of 2 ml	As for (A) with greater palatine nerve block 0.5 ml	
Mandibular teeth			
1. Any one incisor	Labial infiltration of 1 ml	As for (A) with lingual infiltration 0.5 ml	
2. Canine	Labial infiltration of 1.5 ml or mental nerve block 1.5 ml		

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Site	A. Conversation	B. Extraction	C. Other treatment
3. Premolars	Mental nerve block 1.5 ml or inferior dental nerve block 1.5 ml.	Inferior dental and lingual nerve block 1.5 ml with buccal infiltration 0.5 ml	
4. 54321 12345	Bilateral mental nerve block total 3 ml	As for (3) above for both sides, or bilateral mental injections 1 ml.	
5. Molars	Inferior dental nerve block 1.5 ml	Inferior dental and lingual nerve block 1.5 ml with buccal infiltration 0.5 ml	
6. Premolars and molars			
7. 12345678	Inferior dental nerve block with labial infiltration over central incisor 1 ml	As for (5) and (6) above with lingual and labial infiltration over central incisor 0.75 ml	

CONSCIOUS SEDATION

In some cases local anesthesia is not sufficient to reduce the patient's pain and apprehension and general anesthesia has its own limitations and complications. In these cases a process called conscious sedation is practiced. Here the patient shows a minimally depressed level of consciousness with ability to independently and continuously maintain an airway and respond appropriately to physical stimulation and verbal command.

OBJECTIVES OF CONSCIOUS SEDATION

1. Patient's mood is altered.
2. Patient is more cooperative.
3. Pain threshold is elevated.
4. All protective reflexes are active.
5. Only minor deviation is there in vital signs.
6. It can produce mild amnesia.

DRUGS COMMONLY USED IN CONSCIOUS SEDATION

1. Nitrous oxide (Inhalation)
2. Barbiturates (parenteral)
3. Psycho sedative drugs (Diazepam, chlorpromazine)
4. Narcotics (morphine)

GENERAL ANESTHESIA

General anesthesia are drugs which produce reversible loss of all sensation and consciousness. The cardinal features of general anesthesia are:

- Loss of all sensation, especially pain.
- Sleep (unconsciousness) and amnesia.
- Immobility and muscle relaxation.
- Abolition of reflexes.

General anesthesia is very rarely used in dental practice.

STAGES OF GENERAL ANESTHESIA

1. Stage of analgesia:
 - pain gradually disappears
 - patient is conscious and can hear and see
 - patient is in a dream like state
 - reflexes and respiration are normal.
2. Stage of excitement/delirium:
 - patient is excited and may jump off the table, hence it is a dangerous stage
 - muscle tone increases, jaws are tightly closed
 - breathing is jerky
 - vomiting, involuntary micturition or defaecation may occur
 - B.P. rises, pupil are dilated.
3. Stage of surgical anesthesia:
Divided into 4 PLANES:
 - Plane 1: moving of eye balls
 - Plane 2: corneal and laryngeal reflexes are lost
 - Plane 3: dilation of pupil starts, there is loss of light reflexes
 - Plane 4: paralysis of intercostal muscles, pupil is dilated, abdominal respiration seen
 - Surgery is carried out between plane 1 and plane 2
4. Stage of medullary paralysis:
 - cessation of breathing, failure of circulation, death.

PREANESTHETIC EVALUATION OF PATIENT

A detailed preanesthetic evaluation of the patient should be done. This is done to determine the following:-

1. The patient's physical and psychological condition.
2. The need for the medical consultation.
3. The history of any previous unpleasant anesthetic experience.

4. The specific drug sensitivity of the patient.
5. The need for premedication or intra operative sedation.
6. The time to be allotted for the procedure.
7. The technique or method to be used.
8. The choice of an anesthetic solution.
9. The need and quantity of vasoconstrictor.

CLASSIFICATION OF GENERAL ANESTHESIA

1. Inhalation anesthesia
 - i. Gases:
 - Nitrous oxide
 - Cyclopropane
 - ii. Volatile liquid:
 - Halothane
 - Isoflurane
 - Ether
 - Methoxy flurane (chloroform)
2. Induction anesthesia:
 - Thiopentone
 - Methohexitone
3. Basal anesthesia:
 - Diazepam
 - Lorazepam
 - Midazolam
4. Neurolept analgesia:
 - Droperidol + Fentanyl
5. Dissociative anesthesia:
 - Ketamine
6. For short surgical procedures
 - Atthesin
7. Others:
 - Propofol
 - Etomidate

JORGENSEN Technique- It is an IV sedation procedure used in dental practice.

The drugs used are:-

- Pentobarbitol
- Mepridine
- Scopolamine

PROPERTIES OF SOME INDIVIDUAL GENERAL ANESTHETIC AGENTS USED VIA INHALATION

S.No.	Effect	Nitrous oxide	Ether	Halothane
1.	Physical state	Gas	Volatile liquid	Volatile liquid
2.	Inflammability	—	++	—
3.	Induction	slow	quick	intermediate
4.	Analgesia	good	moderate	Good
5.	Muscle relaxation	poor	poor	moderate
6.	Respiration	little depression	moderate depression	moderate depression
7.	Bronchial irritation	+	+	—
8.	Blood pressure	No change	No change	Decreased
9.	Heart rate	may increase	No change	Dysrhythmias
10.	Hepatotoxicity	—	—	++
11.	Post- op vomiting	—	+	+
12.	Bone marrow depression	++	—	—
13.	Metabolism	Negligible	Negligible	20% in liver

PROPERTIES OF SOME INDIVIDUAL GENERAL ANESTHESIA AGENTS USED VIA IN INDUCTION

S.No.	Effect	Thiobarbiturates	Oxyborbiturates	Alkyl phenol	Phencyclidine (Ketamine)
1.	Respiratory system	Depressed	Depressed	Depressed	Stable
2.	Cardiovascular system	Depressed	Depressed	Depressed and hypotension	Stable of increase in heart rate and B.P
3.	Pain on injection	—	Occurs	Occurs	—
4.	Thrombophlebitis	—	Occurs	Occurs	—
5.	CNS excitability	—	Convulsion may be there	—	Convulsion may be there
6.	Salivation	Less	Less	Less	High
7.	Laryngeal reflexes	Activated	Activated	Depressed	Preserved in lighter plane
8.	Recovery	Slow somnolence	Rapid and clear	Rapid and clear	Hallucination, nausea and vomiting
9.	Contraindications	porphyria	Convulsion	Egg allergy	Convulsion, hypertension and heart disease

In case of DIAZEPAM sedation the correct level is best explained by VERILL'S SIGN - 30 percent eyelid ptosis, blurring of vision and slurring of speech.

COMPLICATION OF GENERAL ANESTHESIA

1. During anesthesia

- i. Respiratory depression and hypercardia.

- ii. Salivation, respiratory secretions-less now as non irritant anesthesia are used.
- iii. Cardiac arrhythmias, asystole.
- iv. Fall in B.P
- v. Aspiration of gastric contents.
- vi. Laryngospasm and asphyxia.
- vii. Awareness - dreadful perception and recall of events during surgery.
- viii. Delirium, convulsion
- ix. Fire and explosion - rare row due to use of non-inflammable agent.

2. After anesthesia:
 - i. Nausea and vomiting
 - ii. Persisting sedation
 - iii. Pneumonia, atelectasis
 - iv. Oxygen toxicities - liver, kidney damage.
 - v. Nerve palsies
 - vi. Emergency delirium
 - vii. Cognitive defects

PREANESTHETIC MEDICATIONS

1. For local anesthesia:
 - i. Barbiturates
 - Phenobarbitone (50-100 mg, I.V/I.M/P.O)
 - ii. Narcotics
 - Morphine sulphate (8-16 mg, I.V/I.M)
 - iii. Ataractics
 - Promethazine hydrochloride, an anti emetic (25-50 mg, I.V/IM/P.O)
 - Diazepam, an amnesic and an anti anxiety drug (5-15 mg, P.O/I.V/IM)
2. For general anesthesia
 - i. Barbiturates
 - Phenobarbitone (50-100 mg, I.V/ I.M/P.O)
 - ii. Narcotics
 - Morphine sulphate (8-16 mg, I.V/I.M)
 - iii. Ataractics
 - Promethazine hydrochloride, an anti emetic (25-50 mg, I.V/I.M/P.O)
 - Diazepam, an amnesic and an anti anxiety drug (5-15 mg, P.O/I.V/I.M)
 - iv. Belladonna derivatives
 - Atropine sulphate, an autonomic stabilizer (0.2-0.5 mg, I.M/I.V)
 - v. Anti secretary
 - Ranitidine, a H₂ blocker
 - Or
 - Omeprazole, a P.P.I.

ANESTHESIA IN PREGNANCY

1. General anesthesia is best avoided except in an emergency. GA is avoided especially in first and third trimester.

2. Diazepam if given in pregnancy can cause withdrawal effects on the fetus and can cause fetal abnormalities.
3. Vasoconstrictor drug felypressin (octopressin) has an oxytotic effect to hasten child birth and can impede fetal circulation and can cause fetal distress.
4. The safety local anesthesia in pregnancy is 2 percent lignocaine with 1: 80,000 adrenaline but its dose is limited to 3.6 ml at each visit.
5. Vasoconstrictor are avoided in pregnancy induced hypertension and preeclampsia.

ANESTHESIA IN PEDIATRIC PATIENTS

1. Children are anatomically and psychologically less developed than adults.
2. The dental environment, site of needle and injection makes them apprehensive so premedication or use of flavored topical anesthesia is practiced.
3. Needle size should be smaller, 1.5 cm long.
4. Head stabilization is to be considered to reduce potential complications.
5. Inferior alveolar nerve block is less recommended as the width of ramus is less leading to easy entering into parotid gland and the primary teeth roots are resorbed thus cutting their nerve supply.

CHOICE OF ANESTHESIA

The choice of anesthesia for dental procedures depends on various factors, but chiefly on surgical factors.

The surgical factors influencing the choice of anesthetic technique include the aspects of the patient's medical history and their anticipated level of co-operation. Indeed these factors may dictate that a general anesthetic is required irrespective of the surgical task. There are a variety of surgical factors that indicate the use of local or general anesthesia:

Local anesthesia is best for:

- i. Procedures taking less than 30-45 min
- ii. Single operative site in the mouth
- iii. Readily accessible areas of the mouth.

General anesthesia is best for:

- e. Complicated procedure of unpredictable duration.
- f. Multiple operative sites.
- g. Working in areas of the mouth with difficult access (e.g. Surgical procedures in the palate).

FURTHER READING

1. Adams, Hewitt, Rogers — Emergency anaesthesia.
2. Allen — Dental anaesthesia and analgesic (Local and general), 3rd ed.
3. AP Chitre — Manual of local anaesthesia in dentistry.
4. C Richard, Bennett — Monheim's local anaesthesia and pain control in dental practice, 7th ed. 1990.
5. CS Ward — Anaesthetic equipments.
6. DE Jong — Local anaesthetics
7. DH Roberts and JH Sowroy — Local analgesia in dentistry, 3rd ed.
8. Dionne, Phero, Backer — Management of pain and anxiety in the dental office.
9. Evers, Haegerstam — Introduction to dental local anaesthesia.
10. Guyton and hall — Textbook of Medical Physiology, 9th ed.
11. James M Dell — Clinical dental anaesthesia.
12. Sembulingam — Textbook of Physiology
13. Stanley F Malamed — Handbook of Local Anaesthesia, 5th ed.
14. Stanley F Malamed — Sedation, A guide to patient management, 4th ed.

Exodontia

7

Exodontia is the painless removal of whole tooth or teeth or tooth root with minimal trauma to investing tissues, so that the wound heals uneventfully and with no postoperative preprosthetic problems.

INDICATIONS

1. Peridontal disease (In grade II and III mobility cases).
2. Severe non-restorable carious lesion.
3. Pulp pathology (In case of pulpal necrosis and irreversible pulpitis).
4. Cracked/broken tooth especially in the mesiodistal direction or at the cervical line.
5. Teeth in the line of a jaw fracture.
6. Impacted or ectopically present teeth.
7. Supernumery teeth.
8. Teeth involved with cysts or tumors of the jaw.
9. Teeth removed due to orthodontic reasons (for space gaining).
10. Malposed or malpositioned teeth.
11. Teeth removed due to prosthetic considerations.
12. Teeth in the direct field for radiotherapy to the jaws may be removed prophylactically.
13. Over-retained deciduous teeth.
14. Teeth involved in the foci of infection.
15. Teeth removed due to esthetic reasons (especially in severally tipped canines).

CONTRAINDICATIONS

All contraindications whether local or systemic, can be relative or absolute depending upon the general condition of the patient. When the contraindication is absolute, extraction should never be done to avoid any risk to the patients, whereas if the contraindication is relative then extreme care must be taken before any extraction is done.

I. Relative Contraindications

A. Local

- i. *Localized periapical pathology*: If extraction is done then infection may spread generalized and systemically, so antibiotics should be administered before extraction.
- ii. *Presence of oral infection like Vincent's Angina, Herpetic gingivostomatitis*: It should be treated first followed by extraction.
- iii. *Acute pericoronitis*: Pericoronitis should be treated first followed by extraction of the involved tooth; otherwise bacterial infection can descend to lower head and neck region.
- iv. Malignant disease such as teeth that are located within an area of tumor, if removed could disseminate cells and thereby hasten the metastatic process.
- v. Extraction of teeth in previously irradiated jaw which may lead to osteoradionecrosis

and therefore must be done with extreme precautions. Details will be discussed later in the chapter.

B. Systemic

- i. *Uncontrolled diabetes mellitus*: Diabetic patients are more prone to infection and delayed wound healing. Extraction should be done after proper precautionary diagnosis and under prophylactic antibiotics.
- ii. *Cardiac disease* like hypertension, congestive cardiac failure, myocardial infarction and coronary artery diseases.
- iii. *Blood Dyscrasias*: Anemic, hemophilic and patients with bleeding disorders should be dealt with extreme care to prevent excessive postoperative bleeding.
- iv. *Medically compromised patients*: Patients with debilitating diseases (as in T.B) and poor medical history should be given proper care and preoperative evaluation of these patient's general conditions is a must.
- v. *Addison's disease and patients on long term steroid therapy*: Hypoadrenal crisis may occur in these patients due to increase in the stress during the dental procedures. To prevent this 100 mg of hydrocortisone should be prescribed prior to the procedure.
- vi. *Fever of unexplained origin*: The most common cause of unexplained fevers is sub acute bacterial endocarditis and extraction in this condition may cause bacteremia, hence proper care should be taken.
- vii. *Nephritis*: Extraction of chronically infected teeth often provokes an acute nephritis hence before any dental procedure thorough investigations should be done.
- viii. *Pregnancy*: Extraction should be avoided in first and third trimester and extreme care should be taken during dental radiography and drug administrations.
- ix. *During menstruation cycle*: As there is more bleeding, patient is mentally and nervously not so stable.

- x. *Psychosis*: Proper precautions and drugs should be given in neurotic and psychotic patients.

II. Absolute Contraindication

A. Local

- Teeth involved in arterio-venous malformations.
- If extraction is done, then it may lead to death.

B. Systemic

- i. Leukemia
- ii. Renal failure
- iii. Cirrhosis of liver
- iv. Cardiac failure

Note: Detailed management of the patient suffering from systemic contraindications is discussed earlier in chapter, management of medically compromised patients.

PRE-OPERATIVE ASSESSMENTS

Proper assessment of the conditions before any surgery is very important to avoid or to overcome the potential complications. The assessments to be done can be broadly divided into:

1. *Evaluation of the patient's anxiety level*: Fear of the local anesthesia, injection, pain of the surgical procedure is to be done to decide upon the procedure to follow.
2. *General and medical health status of patient*: Evaluation to rule out the contraindications and to plan the precautions to be taken if any.
3. *Clinical evaluation*:
 - i. *Crown of the teeth*:
 - present/absent/fractured/carious that may effect the forceps application
 - restorations that may weaken the tooth.
 - Attrition and strength of crown
 - Accessibility of tooth in the mouth.

- ii. *Root of the tooth:*
 - Size, shape, number and structure.
 - Mobility, resorption, fracture and ankylosis
 - Hypercementosis or other pathology.
- iii. *Surrounding structures:*
 - Deposits around tooth
 - Adjacent teeth's condition
 - Periapical disease and other pathology
 - Mouth opening of patient
4. *Radiological evaluations:* This is done mainly to confirm the clinical evaluation of the crown, root and surrounding structure (Fig. 7.1).

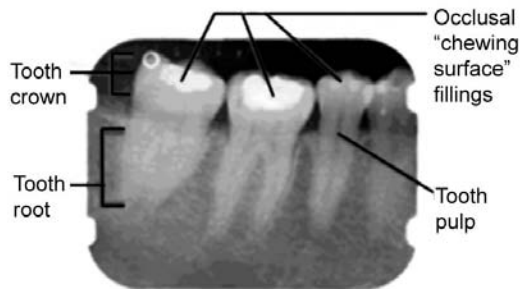


Fig. 7.1: Parts of the tooth to be assessed radiographically

ARMAMENTARIUM REQUIRED FOR EXODONTIA

For an uncomplicated extraction we mainly need the extraction forceps and elevators. In surgical extraction (Trans-alveolar) the instruments needed, except extraction forceps and elevators are:

1. Scalped handle, size 3
2. B.P Blade, no. 15
3. Check and tongue retractors
4. Dental hand piece and burs
5. Chisel and mallet
6. Bone rongeurs and bone files
7. Artery forceps
8. Syringe
9. Suction tip
10. Toothed dissection forceps
11. Suture needle, needle holder, suture material and scissors
12. Mouth props.

Extraction Forceps

Classification

1. Maxillary forceps:
 - i. Maxillary anterior forceps
 - ii. Maxillary premolar forceps
 - iii. Maxillary premolar root forceps
 - iv. Maxillary right molar forceps
 - v. Maxillary left molar forceps
 - vi. Bayonet forceps
 - vii. Maxillary third molar forceps
 - viii. Maxillary cowhorn forceps
2. Mandibular forceps:
 - i. Mandibular anterior forceps
 - ii. Mandibular premolar forceps
 - iii. Mandibular premolar root forceps
 - iv. Mandibular molar forceps
 - v. Mandibular cowhorn forceps.

Details about the forceps are discussed earlier in the chapter of "Armamentarium used in oral and maxillofacial surgery".

Principles for the use of Forceps

Forceps are used for two purposes:

1. Expansion of bony socket
2. Removal of tooth from socket

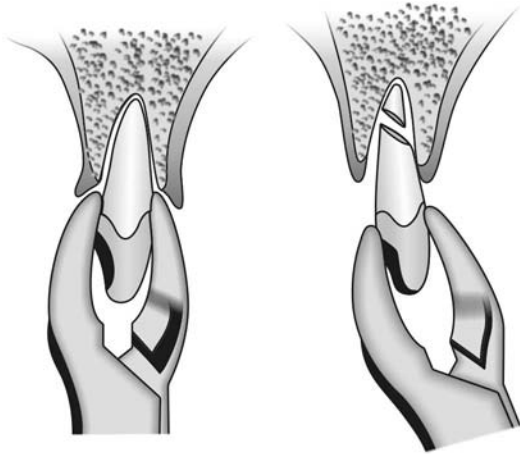
Five types of motions are used to expand the socket and luxate the teeth:-

1. Apical pressure to expand bony socket and to displace the centre of tooth rotation, apically.
2. Buccal force to expand the buccal crestal bone.
3. Lingual force to expand the lingual crestal bone.
4. Rotational force to cause internal expansion of tooth socket. This is particularly useful for tooth with single conical root.
5. Tractional force, which is applied at the last and is gentle to deliver the tooth from the socket after adequate bony expansion is achieved.

General Rules of Forceps Use

- Correct forceps selection for particular tooth
- Grasp forceps with palm as far from beak

- Long axis of forceps beak should be parallel to long axis of tooth.
- Forceps should hold the tooth without injuring the adjacent tooth and structures as apical as possible, the root surface.



(A) Correct

(B) Incorrect

Fig. 7.2: Principle of forcep application
(Apply apically)

Elevators

Classification

I. According to use:

1. Elevators designed to remove the entire teeth
2. Elevators designed to remove roots broken off at the gingival line.
3. Elevators designed to remove root broken off halfway to the apex
4. Elevators designed to remove the apical third of the root
5. Elevators designed to reflect the mucoperiosteum (periosteal elevators) before forceps or extracting elevators are used.

II. According to form:

1. Straight elevators
2. Angular elevators
3. Cross bar elevators (where handle is at right angle to the shank).

Indications for Use of Elevators

1. It is used to luxate and remove teeth which cannot be engaged by the beaks of the forceps such as impactions, malposed teeth, extensively decayed tooth and anteriorly drifted teeth.
2. It is used to reflect mucoperiosteal membrane.
3. It is used to remove roots, fractured or carious.
4. It is used to loosen teeth prior to the application of forceps.
5. It is used to split teeth which have had grooves cut in them.
6. It is also used to remove intraradicular bone.

Precaution to be followed in using Elevators

- a. We should never use the adjacent tooth as a fulcrum since this will damage or even luxated the adjacent tooth.
- b. We should always use finger guard to protect the patient tissue since slipping of the instrument point into the soft tissue might cause perforation of blood vessels and nerves.
- c. The forces applied through the instrument should be under control; failing to do so would cause fracture of the maxilla, mandible or the alveolar process.
- d. The instrument tip should deliver the force in the correct direction to avoid the accidental forcing of the tooth into maxillary sinus.

Principles for the Use of Elevators

These are:

- i. **Lever principle:** Mostly used in elevators is lever of 1st order where fulcrum is in between effort and resistance. The mechanical advantage is 3 and it depends on the distance of the load and resistance from fulcrum. We should increase the

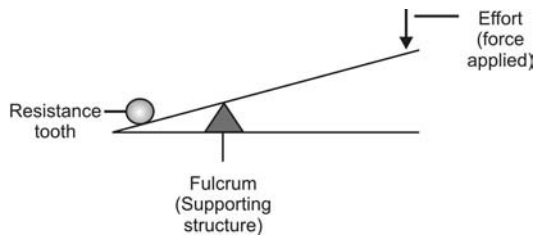


Fig. 7.3: Lever principle

distance of effort from fulcrum to get more advantage (Fig. 7.3).

- ii. *Wedge principle:* It is used either alone or along with lever principle. Here the elevator is forced between the root of tooth and the investing bony tissue parallel to the root. Mechanical advantage is 2 to 5 (Fig. 7.4).

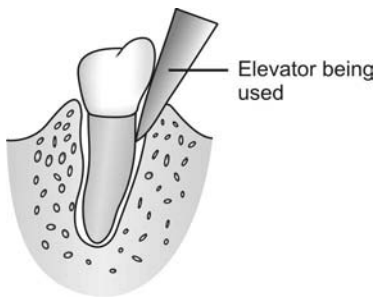


Fig. 7.4: Wedge principle

- iii. *Wheel and Axle principle:* It is actually a modification of lever principle and is used either in combination with lever or wedge principle. Mechanical advantage gained is 4.6 (Fig. 7.5).

TECHNIQUE FOR EXTRACTION OF TOOTH

There are mainly two techniques used for extraction of teeth:

1. *Intra alveolar technique:* This technique relies on the ability to gain sufficient grip on the root of the tooth by forcing the blades of the instrument into the periodontal space between the root and the alveolar bone. Thus, it is also called 'Forcep technique' or 'Closed method of extraction'.

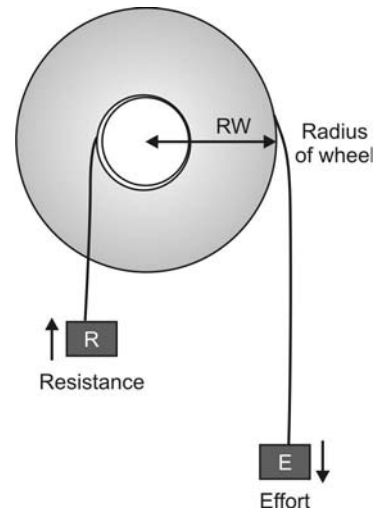


Fig. 7.5: Wheel and axle principle

2. *Transalveolar technique:* This technique is used when roots of the tooth cannot be approached and gripped using the forceps technique. Here, the bone is removed from around the roots. Thus, it is also called 'Surgical technique' or 'Open method of extraction'.

Rubber Band Extraction is done in case of extraction in patients with bleeding disorders.

PRINCIPLES OF EXODONTIA

1. Applying displacing force to a tooth or root: This is done either directly by using a forcep or indirectly via a fulcrum using an elevator.
2. Expansion of the socket: This is done to make the surrounding bone loose to facilitate easy removal of tooth.
3. Removal of bone surrounding the root: This is done in cases where the expansion of bone is not possible.
4. Sectioning the tooth: This is done in extreme cases where the tooth is not being delivered otherwise.

PATIENTS AND OPERATOR'S POSITION

Good access and ease of extraction is the primary goal in positioning both the patient and the operator. There are some recommended positions of the patient and the operator which provides maximum accessibility and mechanical effectiveness for extraction. These are:

Sl. No.	Tooth to be extracted	Patient position	Height of dental chair	Operator's position
1.	Maxillary anterior teeth	Upright or supine or semi recumbent position	Target tooth at shoulder height of operator or lean patient back a little and operator stand slightly further away (toward's patient's feet)	At right side of patient and in the front of the patient
2.	Maxillary posterior teeth	Supine or semi recumbent position		
3.	Mandibular left tooth (third quadrant)	Upright or supine or semi recumbent position	Target tooth at level of operator's elbow	
4.	Mandibular right tooth (fourth quadrant)			At right side of patient and slight behind

ORDER OF EXTRACTION OF TEETH

In case of multiple extractions there are certain rules to be followed for the order of extraction. These are:

- Maxillary tooth should be extracted before the mandibular tooth as maxilla gets anesthetized easily and also prevents the fall of fractured crown, debris, or restorations into the otherwise open extracted mandibular socket.
- Posterior tooth should be extracted before anterior tooth as post extracted blood gets collected in the posterior region which does not alter the visibility of the anterior region.
- First molars and canine should be extracted after the extraction of the adjacent tooth as these tooth are the bony pillars of face and

also it helps in getting better purchase on the tooth.

- The sequence of extraction is:
 - Third molar
 - Second molar
 - Second premolar
 - First molar
 - First premolar
 - Lateral incisor
 - Canine
 - Central incisor.

Intraalveolar Technique of Extraction

Steps of Intraalveolar Extraction

1. Detaching gingival attachment around cervical part of tooth using a periosteal elevator, Moon's probe, Woodson's elevator or B.P blade.
2. Luxating of the tooth by using a forceps or elevator
3. Adapting forceps as apical as possible and along the long axis of the tooth.
4. Lifting the tooth with slight tractional force, don't pull the tooth.
5. Debriding the socket. Applying pressure using gauge and postoperative care and instruction to patient.

Direction of application of force and movement for individual teeth:

Sl. No.	Tooth in maxilla	Root pattern	Movement
1.	Central incisor	Conical, circular cross-section	Rotation
2.	Lateral incisor	Oval cross-section, flattened mesio distally	Buccal + gentle rotation
3.	Canine	Long thin root, triangular cross-section	Buccal
4.	First premolar	Two thin root, very fragile, buccal and palatal	Wiggle and pull, only tooth in mouth to pull out.
5.	Second premolar	One generally strong root	Buccal

Contd...

Contd...

Sl. No.	Tooth in maxilla	Root pattern	Movement
6.	First molar	Two thin buccal roots and one strong palatal root, three roots diverge markedly	Buccal predominantly + Disto-buccal twist to deliver.
7.	Second molar	Normally three roots as in first molar	Buccal + Disto-buccal twist
8.	Third molar	Roots are variable	Buccal + Disto-buccal twist.

Sl. No.	Tooth in mandible	Root pattern	Movement
1.	Central incisor + Lateral incisor	Thin oval cross-section, flattened mesio-distally	Bucco-lingual
2.	Canine	Long thin root-triangular cross-section.	Bucco-lingual
3.	First and second premolar	Round cross-section	Rotation
4.	First molar	Two mesial root and one distal root.	Bucco-lingual + Figure of '8'
5.	Second molar	Normally as for first molar	Lingual-Buccal + Figure of '8'
6.	Third molar	Root pattern very variable.	Lingual + Figure of '8'

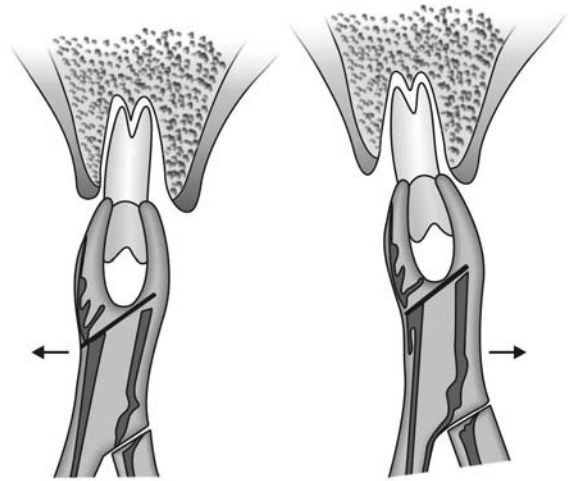


Fig. 7.7: Removal of maxillary first premolar

fractured at the cervical region if forcep is applied at tooth surface, it will lead to breakage of tooth. In these cases alveolar application of forceps is done. Here, the beaks of the forceps are applied a little above the edge of the alveolar process. This enables easy removal of tooth without its breakage.

Transalveolar Technique of Extraction

Indications of Transalveolar Extractions

1. Any tooth that is resistant to normal intra-alveolar extraction
2. Retained roots or teeth with severe carious destruction that cannot be grasped with forceps or delivered by an elevator.
3. Impacted teeth
4. Sclerosed, dense and unyielding bone which is resistant to expansion.
5. Hypercementosis and ankylosed teeth.
6. Teeth with anatomic anomalies like dilacerations.
7. Teeth with multiple or unfavorable roots.
8. Any tooth or root close to important structures like maxillary sinus, Mandibular canal.

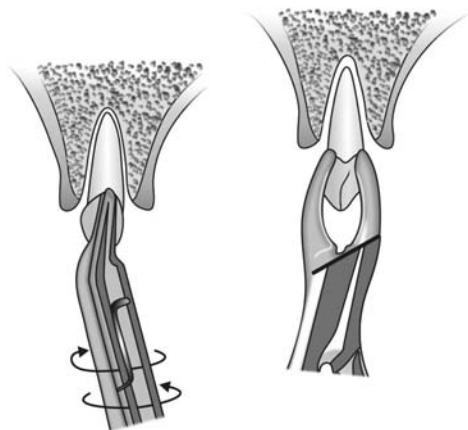


Fig. 7.6: Removal of maxillary canine

In certain cases as in case of extraction of brittle tooth or tooth with cervical caries or tooth

9. For pre-prosthetic adjustment of bone contour in preparation for denture, bridges or dental implants.

Advantages of Transalveolar Extractions

1. Increased visibility and accessibility of the operating area.
2. Reduced undue laceration of the adjoining tissues.
3. Prevents fear of tooth breakage
4. Reduces postoperative complications

Steps of Transalveolar Extractions

1. Administration of proper anesthesia
2. Making the incision and raising the proper mucoperiosteal flap
3. Removal of the buccal bony plate
4. Division of tooth, if required
5. Delivery of the tooth and root
6. Control of hemorrhage
7. Alveoplasty and other tissue filing, if required
8. Debriding and toilet of socket with saline
9. Suturing of flap and post operative care.

Principles of Flap Design

1. Shape of flap: A flap can be one sided, two-sided or three- sided depending on the case and the operator (Figs 7.8 to 7.10).
2. Access: Flap should be large enough to permit clean access to operation site without any tissue tear.
3. Blood supply: The base of the flap should be large enough to provide proper blood supply
4. Avoid vital structures: Important structures like mental nerve should be taken care of.
5. Extending flaps: Flap should be planned properly to include all defects and properly fulfill the need.
6. Suture over bone: The flap margins should be over sound bony structure after the removal of the bone.
7. Ease of closure: Flap should include all the tissues like the whole inter dental papilla so that the replacement of flap should not alter the anatomy.
8. Closure of an oro-antral communication: If there is a risk of oro-antral communication than the flap should be sufficient to be able to close it.

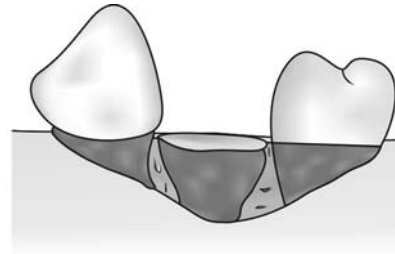


Fig. 7.8: One-sided flap

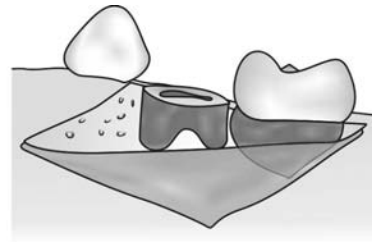


Fig. 7.9: Two-sided flap

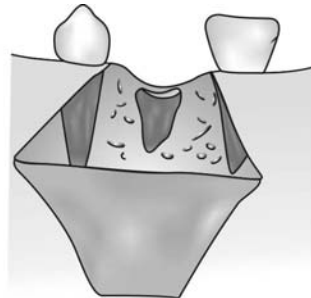


Fig. 7.10: Three sided flap

REMOVAL OF THE BUCCAL BONY PLATE

The buccal bony plate is removed to expose the tooth and provide a clear path of exit and a

suitable point of application of elevator. This is done either by rotary cutting instruments (tungsten carbide burs or sharp stainless steel burs) along with a coolant to reduce the heat and wash away the debris or using a chisel or gouge (hard instrument). The use of rotary instrument is preferred by most dentists as this method cuts bone more predictably and efficiently. Bone can be removed either, by simply shaving down with a large bur or else a block of bone is outlined using a smaller bur and the whole piece is then dislodged (postage stamp method) (Fig. 7.11).

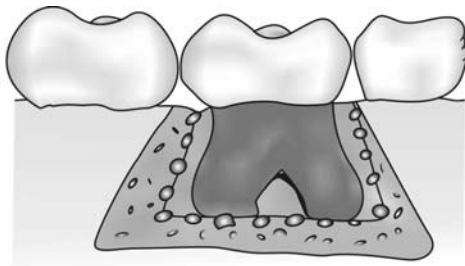


Fig. 7.11: Postage—Stamp method of bone removal

Removal of Small Root Fragments and Root Tip

The removal of small root fragment should be tried first by closed method, using root forceps, shoehorn elevator or root tip pick. If this is not successful due to deep embedding of the root fragment or any other pathosis like hypercementosis or ankylosis then open method should be considered. Open method for removal of small root fragment can be either done by the traditional way or by 'open window approach' where a small hole is drilled by a bur at the apex of the root which enables its pushing by a straight elevator (Fig. 7.12).

In certain cases where the root tip is smaller than 5 mm and is embedded deep to be removed by closed method and if open method is considered then excess damage to the tissues

and adjacent vital structure can be there, then the root tip can be considered to be left back. In these cases the patient should be informed and routine examination for any complication should be done.

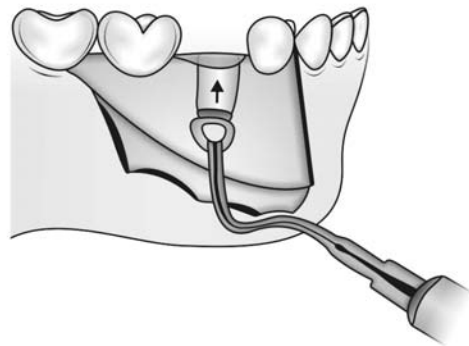


Fig. 7.12: Open window approach for removal of root fragments

Extraction of Deciduous Teeth

Generally the extraction of deciduous teeth is easier but it may have the following difficulties:

1. The underlying developing permanent tooth: The blades of the elevator should not damage the erupting permanent tooth.
2. Fragility of deciduous roots: There may be some root fragments of the fragile resorbing deciduous root left behind in the socket. This should be left behind to prevent damage to the permanent tooth while removing them.
3. Carious crown: In case of carious destruction of the deciduous tooth, the application of forceps becomes very difficult. In these cases elevator or retraction of the gingival tissues is needed.
4. Restricted access: Limited opening of a child's mouth causes the problems, so the use of mouth props can be considered.

POST-OPERATIVE INSTRUCTIONS

1. Patient should be asked to bite upon the gauze piece for about half-an-hour to

prevent primary hemorrhage and produce clotting.

2. After removing the gauze piece, patient should not probe the socket with the tongue and asked not to suck the wound
3. Immediately, they should have something cold, to decrease the post-operative pain as cold causes vasoconstriction
4. Vigorous rinsing should be avoided
5. Patient is asked to rest in a semi reclining position with two or three pillows under head and avoid any sort of physical exertion
6. Patient should refrain from smoking for the first 24 hrs as nicotine delays wound healing
7. A cold liquid diet for first 24 hrs should be followed by semi-solid food till such time the patient finds it difficult to masticate the normal food. Patient should not have anything hot and should not chew from the operative site. (as hot will cause vasodilatation and will ooze bleeding).
8. Patient should refrain from brushing, but from next day, brushing is done to maintain oral hygiene.
9. Mild antiseptic mouthwash or warm saline mouth rinses, 24 hours post-operatively facilitates healing and helps in cleansing the wound and minimize trismus.
10. In case the extraction was complicated or massive retraction of soft tissue was done, local cold applications are recommended in intermittent and prolonged use.
11. Analgesics and anti-inflammatory agents administered to reduce post-operative pain and swelling.
12. The antibiotics, if started pre operatively are required to be continued for 3-5 days post operatively.
13. The operative site and surrounding structures may remain anesthetized for few hours, hence patient is advised not to bite lip or cheek if order to prevent ulceration of the region.

COMPLICATIONS OF EXODONTIA

Complications of exodontia are studied under two headings:

1. Operative complications:

- a. Fracture of tooth
- b. Injury to the adjacent teeth
- c. Extraction of the wrong tooth.
- d. Fracture of the bony structures like alveolar bone and tuberosity.
- e. Perforation of the maxillary antrum.
- f. Root displaced into the maxillary antrum
- g. Root displaced into the submandibular space
- h. Soft tissue laceration
- i. Injury to the nerve bundles, inferior alveolar nerve.
- j. Hemorrhage
- k. Subcutaneous emphysema
- l. Trauma to the temporomandibular joint.
- m. Thermal injury to the tissues
- n. Vasovagal syncope due to apprehension
- o. Complications related to local anesthesia

2. Post-operative complications:

- a. Post-operative hemorrhage
- b. Post-operative pain
- c. Ecchymosis and hematoma.
- d. Post-operative edema and swelling
- e. Alveolar osteitis
- f. Post-operative infections
- g. Septic periostitis

1. Operative complications: These are those complications that arise during the course of extraction. They are:

a. Fracture of the tooth:

Causes of tooth fracture are:

- Injudicious use of force for luxating the teeth.
- Improper application of forceps
- Wrong instruments used
- Teeth with very large filling
- Teeth that have become brittle because it has been non-vital since long.

- Unfavorable root conditions like dilacerated roots, hypercementosed or additional root.
 - Locked, flaring, bulbous or very thin roots.
 - When the surrounding bone is excessively dense because of condensing osteitis or due to lone standing tooth for a long period.
 - Normal tooth may also fracture if wrong movements are applied.
E.g.; jerking a tooth, pulling in wrong direction or twisting unreasonably.
 - Single beak technique is preferred in these cases.
 - Management of these conditions are discussed earlier
- b. Injuries to the adjacent teeth:
There can be:
- i. Loosening
 - ii. Avulsion or
 - iii. Fracture, of the adjacent teeth during the course of extraction
- i. Loosening of the adjacent teeth is caused due to the fault of the operator by using a wrong instrument (instrument should be narrower than the mesiodistal width of the tooth to be extracted).
Management: If the loosening is less i.e. grade I then no treatment is required. Only patient is asked to take soft diet.
If the loosening is severe, then splint the tooth to the adjacent tooth by arch bars, for 2-4 weeks.
- ii. Avulsion of the adjacent tooth occurs mainly due to the injurious use of instruments.
Management: Immediate reimplantation of the tooth into the socket and stabilization with arch bars followed by endodontic therapy.
- iii. Fracture of the adjacent tooth occurs due to slipping of the forceps due to improper rest and grasp. This fracture generally occurs to the tooth of the opposite arch.
- Management:* The condition is generally treated by composite restoration or capping the fractured tooth with or without endodontic treatment as the condition demands. If the fracture is from the cervical line or below then the tooth has to be extracted.
- c. Extraction of the wrong tooth: Extraction of the wrong tooth occurs due to the fault of the operator and usually occurs in orthodontic extractions. To prevent this, use a marker pencil and mark the tooth to be extracted.
Management: Replant the tooth in the socket immediately and treatment in similar to an avulsed tooth (discussed earlier in this chapter).
- d. Fracture of the bony structures: Fracture of the alveolus takes place during Mandibular and maxillary extractions and fracture of the maxillary tuberosity takes place during maxillary extractions.
Fracture of the maxillary tuberosity takes place during extraction of 2nd and 3rd molar, due to ankylosis of the tooth, whereas fracture of the alveolus takes place due to injudicious use of instrument by closed method of extraction.
Management: Alveolar fracture is treated by intermaxillary fixation and in severe conditions it is treated similarly as that of Mandibular fractures.
Tuberosity fracture is treated by splinting the tooth to maxillary tuberosity by arch bars or in cases of acutely involved tooth, it is separated from the bone and the area is closed by vertical mattress suture.
- e. Perforation of the maxillary sinus: Perforation of the maxillary sinus occur during the course of extraction where the length of the roots of the maxillary bicuspid and molars are invariably long or if the periapical bone is destroyed due to infection or due to injudicious use of instrument.

Management: Treatment of perforation of sinus is discussed later in the chapter of maxillary sinus.

- f. Roots displaced into the maxillary antrum: Root displacement into the sinus occurs while removing bicuspid and molar due to destruction of the apical bone, due to periapical disease or due to injudicious use of instrument.

The root might be pushed into the:

- i. Buccal cortical plate and outer cortex
- ii. Lie between the wall and lining of the maxillary sinus, without causing a breach in the sinus.
- iii. Root piece lying in the maxillary sinus.

Root fragment present in the maxillary sinus should be ascertained by taking an Intra oral periapical radiograph or an occlusal radiograph. Probing of the socket or irrigating should be avoided to prevent pushing of root piece more superiorly and spread of infection.

Management: If the root fragment is present in positions (i) and (ii), then conservative approach is indicated otherwise surgical procedure- Caldwell Luc operation is done. The details of the surgical procedure are discussed in the chapter of maxillary sinus. Conservative approach for the removal of the root piece is best done by reflecting the flap and removing the root piece.

Other ways are:

- Blowing the nose
 - Irrigation of the socket
 - Use of ribbon gauze
- g. Root displaced into the submandibular space: It is a very uncommon complication and occurs while removing fragments of 2nd and 3rd Mandibular molars especially when the lingual cortical plate is damaged due to some periapical disease.

Management: The root fragment is retrieved either via a conservative approach by

pushing the floor of the mouth upwards or by surgically reflecting the lingual flap to reach the submandibular space.

- h. Soft tissue lacerations: Gingival and mucosal lacerations occur due to forceful and improper instrumentation, such as improper support of elevators while luxating the tooth. Lacerations are of the following types:

- i. Puncture wound of the soft tissue (due to elevator slip)
- ii. Stretching or abrasion injury at the corner of the mouth and lip
- iii. Tearing of the mucosal flap due to excess stretching of the inadequately reflected flap edges to gain visibility.

Management: Irregular tissue margins are trimmed and approximated with the help of sutures and control of bleeding is done followed by a dose of prophylactic antibiotics.

- i. Injury to the nerve bundles: The following branches of the trigeminal nerve are at risk during tooth extraction.

- The mental nerve
- The inferior dental nerve (as the nerve lies close to the roots of the lower third molar, the tooth roots are curved around the canal or grooved by it).
- The lingual nerve (course close to lower third molar, often in contact with the lingual periosteum).

Nerve damage during extractions can lead to parathesia or anesthesia of the affected area.

Management: No treatment done, observe for 6 weeks to 6 months. Even after 6 months if there is no sensation then surgical nerve decompression or nerve grafting is done.

- j. Hemorrhage: Discussed earlier in the chapter of the 'management of medically compromised people'.

- k. Subcutaneous Emphysema: It is caused due to:

- the use of air driven instrument during surgery

- the use of pressurized spray to dry the socket

There is immediate swelling and on palpation there is crackling sensation present. *Management:* Proper prevention and care should be taken and it is a self healing condition.

- l. Trauma to the Temporomandibular joint: TMJ trauma or arthritis occurs during the extraction of the lower teeth without the support to the mandible.

Stabilizing the mandible by the operator's left hand or using bite blocks prevents the forces of the dental forceps to be transferred totally to the mandible, causing damage to the capsules and ligaments to the joint.

Management: Analgesics should be administered to relieve pain and hot fermentation packs are given for relief.

- m. Thermal injury: Injury to the soft tissues (lip, cheek, mucosa) and/or the bone can be caused by the heat generated from rotary instruments by use of improper coolant or excessive speed. A 10° rise in temperature can destroy the osteocytes in bone.

Management: Proper coolant and speed management should be instituted. Application of emollient on the tissue provides some relief.

- n. Vasovagal syncope: This is the transient loss of sensation caused due to the stress and apprehension in the patient. The details and management has taken discussed earlier in the chapter of management of medical emergencies.
- o. Complications related to local anesthesia: The various complications caused due to local anaesthesia and its procedure has been discussed earlier in the chapter of anesthesia in oral and maxillofacial surgery.

2. Postoperative complications:

- a. Postoperative hemorrhage: Details are described earlier in management of medical emergencies.

- b. Postoperative pain: Patient usually experience postoperative pain after surgical procedures such as tooth extraction due to the amount of operative trauma caused. The lesser the trauma, the less the postoperative pain experienced by the patient. If pain is present after 2-3 days, then there is secondary infection present.

Management: In mild to moderate pain analgesics should be administered and instructed to be taken before the effect of the local anesthesia subsides. This prevents the intense, sharp pain after local anesthesia subsides.

In severe pain, narcotic analgesics can also be administered.

- c. Ecchymosis and hematoma: Ecchymosis is a bruise, and initially bluish-black mark on the skin, resulting from the release of blood into the tissues either through injury or through spontaneous bleeding from the blood vessels, during surgical procedures.

Hematoma is an accumulation of blood within the tissues that clots to form a solid swelling. Injury to blood vessels leads to hematoma formation.

Management: Patient should be instructed to give cold packs on the affected area for 24 hours, followed by hot pack.

- d. Postoperative edema and swelling: Some degree of swelling is to be expected after any surgical procedure, and greater the amount of operative trauma, greater will be the swelling. It mainly occurs during transalveolar method of extraction in the first 24-48 hrs.

Management: Immediately after surgery, cold packs are applied to prevent swelling. Careful instrumentation and handling of the tissues during surgery minimizes post operative edema. Anti-inflammatory agents are administered to reduce swelling.

- e. Dry socket/Alveolar osteitis: It is also known as fibrinolytic alveolitis, localized osteitis alveolaria, alveolar osteomyelitis, and postoperative osteitis. It is a focal osteomyelitis in which the blood clot has disintegrated or been lost with the production of foul odour and severe pain of throbbing type, but no suppuration.

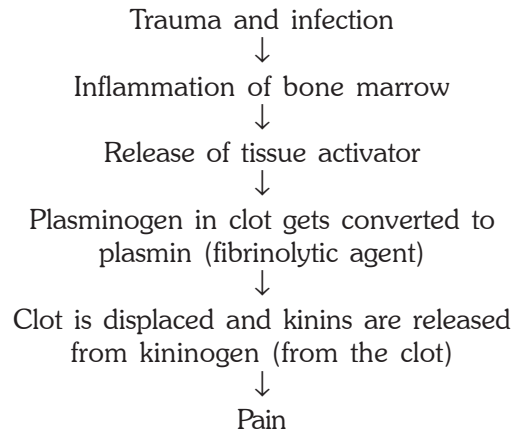


Fig. 7.13: Clinical views of dry socket after mandibular third molar removal (not seen)
(For color version see plate1)

Cause: It causes is not known/obscure. But few assumed etiological factors are:

- Preexisting infection
- Trauma to the bone and soft tissue during extraction
- Decreased bleeding in the wound due to vasoconstrictor in the local anesthesia.
- Infection entering the socket following extraction
- Presence of dense bone
- Loss of blood clot from the socket due to vigorous rinsing and sucking the mouth.
- Smoking
- Oral contraceptives enhance the fibrinolytic activity.

Birn's Hypothesis



Mechanism

There is destruction of clot by proteolytic enzymes produced by bacteria or by local fibrinolytic activity. These fibrinolytic substances are produced from traumatized oral tissues and alveolar bone. Clot lysis occurs by 2 mechanisms:

- i. *Plasminogen dependent*- Tissue activators released from the damaged bone convert plasminogen to plasmin causing breakdown of the blood clot.
- ii. *Plasminogen independent*- this is due to anaerobic micro-organisms.

Features

- Intense, throbbing pain and radiating from the socket
- Blood clot is lost from the socket
- Clot appears dirty grey, ultimately leaving a grey or grayish yellow bony socket which is deprived of granulation tissue (Fig. 7.13).
- Diagnosis is confirmed by probing the socket where bare bone is encountered and is extremely sensitive.
- A foul odour is present and the pain is intense, caused due to chemical and thermal irritation of the exposed nerve endings in the periodontal and the alveolar bones.

- Symptoms start from 3rd - 5th day and if untreated will last for 1-2 weeks.

Management

Best method of prevention is by decreasing the traumatization during extraction and following the proper principles of exodontia.

In the first appointment the socket is irrigated properly with warm normal saline or mild warm antiseptic solution or dilute hydrogen peroxide. The socket is then packed with an obtundant dressing like iodoform gauze dipped in zinc oxide eugenol paste or white head varnish. Patient is recalled after 24 hrs and checked for pain and other features. If the features persist then the same procedure is repeated for 2-3 times until the features disappear. Analgesics are prescribed to reduce pain. Antibiotics are not required until infection is there.

Curettage, packing or suturing should not be done as this dislodges the granulation tissue and delays wound healing.

- f. *Post-operative infections:* Most commonly occurring post operative infections are Herpes and infective endocarditis.

Post operative infections are caused by anaerobic or facultative anaerobic bacterial that are commensal in the mouth. These infections can spread to various facial spaces

of head and neck (E.g.; Ludwigs angina), therefore immediate treatment is required.

Management: Administration of antibiotics and drainage of pus is advised.

- g. *Septic periosteitis:* Inflammation of the periosteum of the extracted socket is known as septic periosteitis.

Management: Hot moist fermentation and warm saline mouthrinses administered. Analgesics prescribed to relieve pain.

FURTHER READING

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4. Eisele — Complications in head and neck surgery.
5. GR Seward, M Harris, DA Gown — Killey and Kay's outline of oral surgery, Part I, 10th ed.
6. Gustav O Krufer — Textbook of oral and maxillofacial surgery, 6th ed.
7. Howe GL — The extraction of teeth, 2nd ed. 1980.
8. Killey HC, Seward GR, Kay LW — An outline of oral surgery, Part I, 1st ed, 1983.
9. Peterson, Ellis, Hupp, Tucker — Contemporary oral and maxillofacial surgery, 4th ed. 2006.
10. Robinson — Tooth extraction, a practical guide.

Impaction

8

Impaction is the cessation of eruption of a tooth caused by a physical barrier or ectopic positioning of a tooth. An impacted tooth is one that is erupted, partially erupted or unerupted and will not eventually assume a normal arch relationship with other teeth and tissues.

FREQUENCY OF IMPACTION (INCIDENCE)

- Mandibular 3rd molar.
- Maxillary 3rd molar.
- Maxillary canine
- Mandibular premolar.
- Maxillary premolar.
- Mandible canine.
- Maxillary central incisor
- Maxillary later incisor

CAUSES OF IMPACTION

The various etiology of impaction is:

1. Local:
 - i. Obstruction in eruption path
 - Caused due to irregularly positioned teeth and presence of an adjacent teeth, or due to high density of overlying and surrounding bone.
 - ii. Lack of space in dental arch
 - Occurs due to crowding or supernumerary teeth.

- iii. Ankylosis of the primary or permanent teeth.
- iv. Over-retained deciduous teeth.
- v. Non-absorbing alveolar bone (dense bone).
- vi. Ectopic position of a tooth bud.
- vii. Dilacerations of root.
- viii. Associated soft tissue or bony lesions.
- ix. Habits involving tongue, finger etc.
2. Systemic:
 - i. Prenatal causes - hereditary
 - ii. Post natal causes
 - Rickets
 - Anemia
 - Tuberculosis
 - Congenital syphilis
 - Malnutrition
- Endocrinal disorders can also cause impaction. E.g. in hypothyroidism, achondroplasia, there is primary retention of the teeth as there is lack of osteoclastic activity (due to non resorption of bone overlying the developing tooth).

COMPLICATIONS OF IMPACTED TEETH

The reasons for the removal of the impacted teeth area:

1. Infection: Pericoronitis, alveolar abscess, periosteitis, osteomyelitis and necrosis of the jaw takes place.

2. Pain
3. Fracture of jaw: Occurs due to weakening of the jaw.
4. Trismus:
It occurs as a sequelae to infection, which causes difficulty in opening the jaw.
5. Chronic check biting;
White patch or chronic ulcer is seen in the area where the tooth hurts, specially in buccal mucosa.
6. Malalignment of other teeth:
Mesial migration of other tooth, e.g. 2nd molar is caused by the pressure from mesially impacted third molar.
7. Others:
Dimness of vision, temporomandibular joint arthralgia can also occur due to impacted teeth complications.

INDICATIONS FOR REMOVAL OF IMPACTED TEETH

- i. Recurrent pericoronitis/pain/infection.
- ii. Deep periodontal pocket, associated with partially erupted tooth.
- iii. To prevent dental caries.
- iv. Preservation of root resorption.
- v. Trauma like recurrent check bite may be responsible for the development of pre-malignant and malignant lesions of oral mucosa.
- vi. To prevent pain of unexplained origin
- vii. Prior to orthodontic treatment.
- viii. Management of cysts or tumors of odontogenic origin.
- ix. Preparation of orthognathic surgery
- x. Pre-prosthetic reasons.
- xi. Impacted teeth in the line of fracture.
- xii. Prophylactic removal, as a part of preventive dentistry.
- xiii. Previous attempted extractions.

CONTRAINDICATIONS FOR REMOVAL OF IMPACTED TEETH

Contraindications for the removal of impacted teeth, primarily involves the patient's physical status.

They are:

- i. Extremes of ages: Very early removal of 3rd molar should be deferred until an accurate diagnosis of impaction can be made.
In an old patient with an impacted tooth that shows no sign of disease and that has a thick layer of overlying bone, is best left in-situ.
- ii. Compromised medical status: If a patient's cardiovascular or respiratory or host defenses for combating infections are compromised, then the surgeon must consider leaving the tooth in the alveolar process.
- iii. Probable excessive damage to adjacent structures: If the impacted tooth lies in an area in which its removal may seriously jeopardize adjacent nerves, teeth, previously constructed bridges, it may be prudent to leave the tooth in place.
- iv. Availability of adequate space: An erupting tooth may simulate an impacted tooth, then clinician may choose to defer removal of the tooth until eruption is complete.
- v. Socio-economic status: Due to fear or patients with busy schedule, may wish to defer the extraction in order to minimize the inconvenience.

PRE-OPERATIVE ASSESSMENT

1. Clinical Assessment

Clinically, treatment planning is based on thorough clinical evaluation of the patient with respect to general and local factors relevant to possible postoperative sequelae.

In general, retruded mandible, restricted mouth opening and small oral commissures are responsible for poor access to the surgical field. Conversely, protruded mandible and large mouth opening will greatly increase access. The clinical assessment for impacted teeth is similar to the pre-operative clinical assessment as discussed under 'Exodontia'.

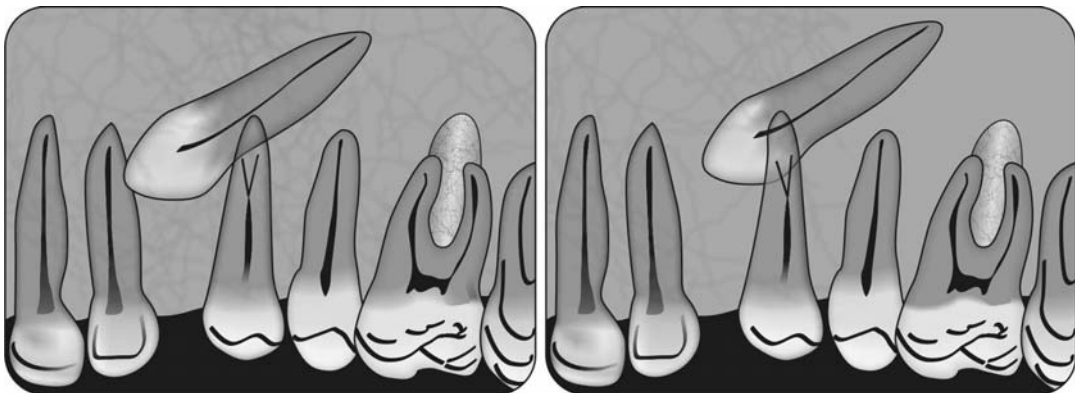
2. Radiological Assessment

- i. *Technique*: The most common techniques for radiological assessment of impacted teeth are:

Intraoral techniques:

- Intraoral periapical radiograph
- Occlusal radiograph
- Clark's rule:

Clark's rule or tube shift technique is used to localization of impacted tooth. In this procedure, two exposures are taken, one in usual position and another in which tube is shifted by 2 cm to one direction (E.g.; in right direction). If in the second film the impacted tooth has shifted to the same direction. (i.e. in right) then the impacted tooth is in the lingual/palatal position, whereas if it is shifted to the opposite direction (i.e. in left) then the tooth is in the buccal position. This is SLOB rule (Same Lingual Opposite Buccal) (Figs 8.1A and B).



Figs 8.1A and B: Palatally positioned impacted canine
(Tooth moved in the same direction as that of collimator)

Extraoral Techniques

The extraoral techniques for detection of impacted teeth in the mandible are:

- Orthopantomograph (OPG)
- Lateral oblique view of the mandible.

For maxillary impactions, the techniques are:

- Orthopantomograph (OPG)
- Postero-anterior view or water's view
- ii. *Assessment of Access to the tooth*: The access of the impacted tooth depends on the position of the external oblique ridge (which appears as a radio-opaque line in the radiograph). If the line is vertical, the access to the tooth is poor and if it is horizontal access is good.
- iii. *Condition of crown and root of tooth involved*.
It is similar to as that discussed under 'Exodontia'.
- iv. *Condition of adjacent structure*: It is similar to that described under 'Exodontia'.
- v. *Wharfe's assessment*: Scoring details for Wharfe assessment are as follows:

	Category	Score
1. Winters classification	Horizontal	2
	Distoangular	2
	Mesioangular	1
	Vertical	0

Contd...

Contd...

	Category	Score
2. Height of the mandible	1 - 30 mm	0
	31 - 34 mm	1
	35 - 39 mm	2
3. Angulation of 3rd molar	1° - 50°	0
	60° - 69°	1
	70° - 79°	2
	80° - 89°	3
	90° +	4
4. Root shape	Complex	1
	Favourable curvature	2
	Unfavourable curvature	3
5. Follicles	Normal	0
	Possibly enlarged	1
	Enlarged	2
6. Path of Exit	Space available	0
	Distal cusp covered	1
	Mesial cusp covered	2
	Both covered	3
Total =		33

vi. Winter lines: In an intraoral periapical radiograph, 3 imaginary lines are drawn known as winter lines (Fig. 8.2). They are as follows:

a. *White line*: It represents the occlusal plane joining the white enamel cusps of the erupted 1st and 2nd molar and is extended posteriorly over the 3rd molar region.

In a vertically impacted tooth, the occlusal surface is parallel to the white line, whereas in mesioangular impaction the occlusal surface of the 3rd molar meets the white line distal to it. In distoangular impaction the occlusal surface meets the white line in front of it.

b. *Amber line*: It represents the bone level. A level is drawn from the crest of the interdental septum between the molars and posteriorly distal to the 3rd molar or to the ascending ramus. The amber line represents the summit of alveolar bone covering the impacted tooth.

c. *Red line*: It is a perpendicular line dropped from amber line to an imaginary point of application of an elevator. It is used to measure the depth at which the impacted teeth lies within the mandible. If the length of the red line is 5 mm or less, then the tooth can be conveniently removed. Increase in the length of the red line, of every additional millimeter, renders the removal of impacted tooth 3 times more difficult. If the red line is more than 9 mm, then the tooth is best removed under general anesthesia.



Fig. 8.2: W-white line, A-amber line, R-red line.

vii. Relation to the inferior alveolar canal: Relationship of the root apex to the inferior alveolar canal is important to detect before extraction, by the help of radiograph (Fig. 8.3).

The relationship of the root apex to the inferior alveolar canal can be as follows:

1. Root apex related but not involving the canal:
 - a. Root and canal are separated
 - b. Both are adjacent
 - c. Superimposed
2. Canal related to changes in the roots;
 - a. Darkening of the root
 - b. Dark and bifid root
 - c. Narrowing of the root
 - d. Deflected root.
3. Root apex related with changes in the canal:
 - a. Interruption
 - b. Converging canal
 - c. Diverted canal

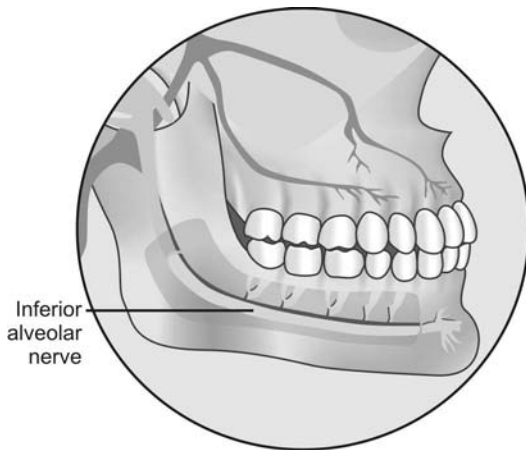


Fig. 8.3: Relationship of mandibular teeth to inferior alveolar nerve and mandibular canal
(For color version see plate 1)

STUDY OF COMMONLY IMPACTED TEETH

Classification

A. Classification of Impacted Mandibular 3rd Molar

- i. *Winter's classification:* This classification is based on the long axis of the impacted tooth (3rd molar) in relation to the long axis of 2nd molar.
1. Mesioangular: Long axis of the impacted tooth is mesially tilted

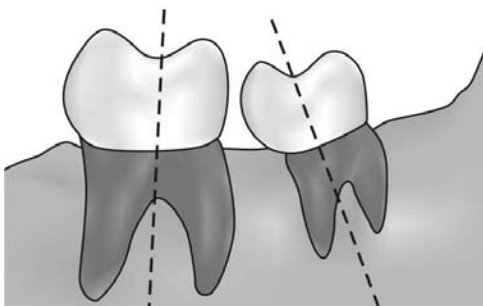


Fig. 8.4

2. Vertical: Long axis of the impacted tooth is vertical

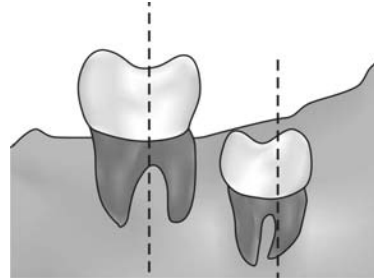


Fig. 8.5

3. Horizontal: Long axis of the impacted tooth is horizontal

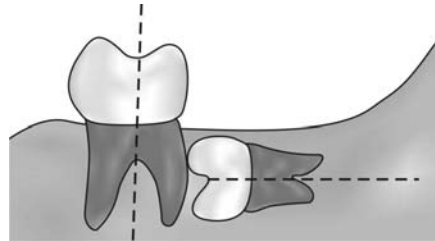


Fig. 8.6

4. Distoangular: Long axis of the impacted tooth is distally tilted

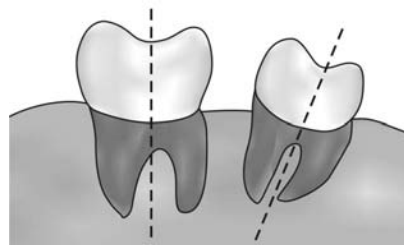


Fig. 8.7

5. Buccoangular: Impacted tooth is erupted buccally

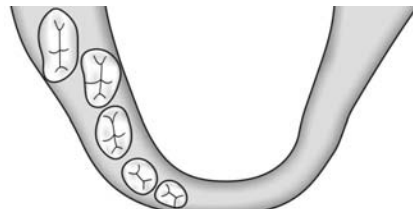


Fig. 8.8

6. Linguoangular: Impacted tooth is erupted lingually

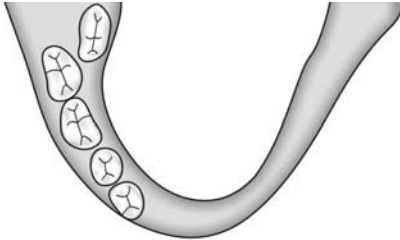


Fig. 8.9

7. Inverted: Impacted tooth is erupted inverted

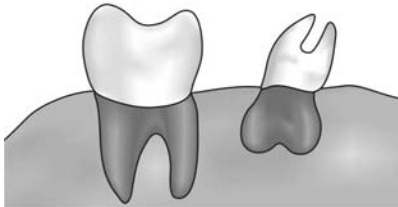


Fig. 8.10

- ii. *Pell and Gregory classification*: There are three folds to this classification:-

1. Based on the space between 2nd molar and ramus:

Class I - Space between anterior border of ramus and distal side of 2nd molar is enough to accommodate the mesiodistal diameter of the 3rd molar.

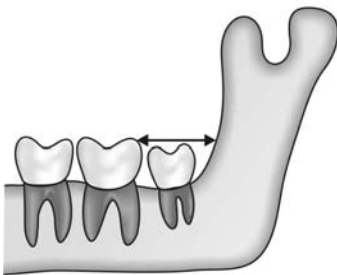


Fig. 8.11

Class II - Space between distal aspect of 2nd molar and anterior border of ramus is less than the mesiodistal diameter of 3rd molar and hence partial buried in ramus.

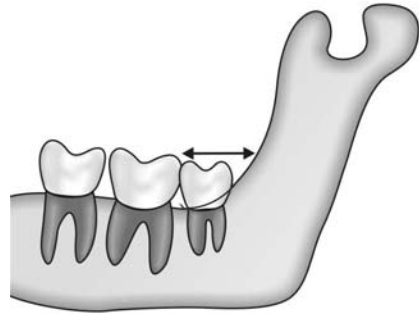


Fig. 8.12

Class III - 3rd molar is totally embedded in bone from ascending ramus because of absolute lack of space.

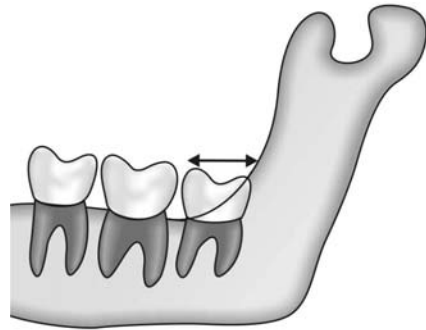


Fig. 8.13

2. Based on relative depth of 3rd molar:

Position A - highest point of 2nd molar and highest point of impacted 3rd molar is in line.

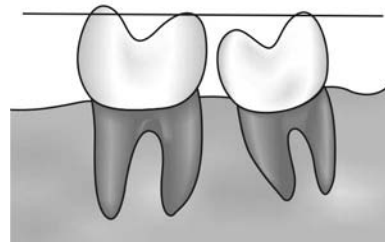


Fig. 8.14

Position B - Highest point of 3rd molar is lower than the highest point of 2nd molar and lies between the occlusal plane of the 2nd molar and above the cervical line of 2nd molar.

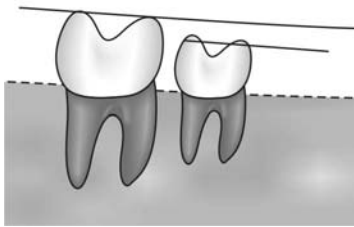


Fig. 8.15

Position C - highest point of 3rd molar lies below the cervical line of 2nd molar.

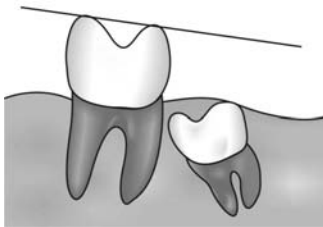


Fig. 8.16

3. Based on long axis of 3rd molar in relation to long axis of 2nd molar:

This classification is similar to that of Winter's classification discussed earlier.

B. Classification of Impacted Maxillary 3rd Molar

I. Based on the position:

1. Vertical impaction: Long axis, the impacted tooth is vertical

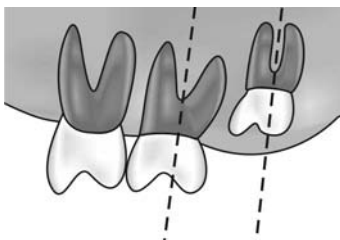


Fig. 8.17

2. Distoangular impaction: Long axis of the impacted tooth is distally tilted

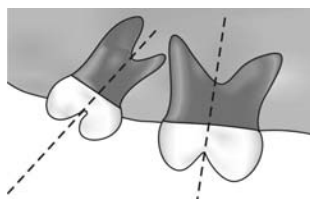


Fig. 8.18

3. Mesioangular impaction: Long axis of the impacted is mesially tilted

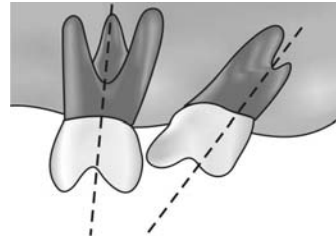


Fig. 8.19

4. Transverse, inverted and horizontal impactions are rare.

II. Based on the depth: (Pell and Gregory)

Position A - highest point of 2nd molar and highest point of impacted 3rd molar is in line.

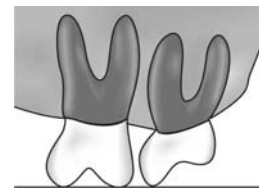


Fig. 8.20

Position B - highest point of 3rd molar is in between plane of occlusion and cervical line.

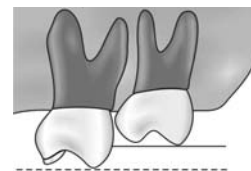


Fig. 8.21

Position C - highest point of 3rd molar is below cervical line.

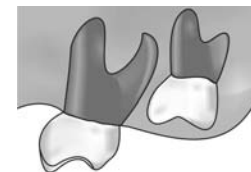


Fig. 8.22

III. Based on the relation to maxillary sinus floor:

1. Sinus approximation (SA): No bone or a thin bone is present between impacted 3rd molar and floor of sinus.

2. No sinus approximation (NSA): 2 mm or more bone is present between the sinus floor and impacted 3rd molar.

C. Classification of Impacted Maxillary Canine

I. Based on the location:-

1. Labially or palatally placed.
2. Intermediate position
 - i. Crown between lateral incisor and premolar.
 - ii. Crown above root tip with labial or palatal orientation of lateral incisor or premolar.
3. *Aberrant position*: Impacted maxillary canine lie in maxillary sinus or nasal cavity.

II. Based on the position and location:-

Class I - Palatally placed canine:-

1. Horizontal position
2. Vertical position
3. Semivertical position

Class II - Labially or Buccally placed canine:-

1. Horizontal position
2. Vertical position
3. Semi vertical position

Class III - Involving both buccal and palatal bone:-

1. Crown of impacted canine on the palatal aspect and root on the buccal aspect.
2. Root of impacted canine on the palatal aspect and crown on the buccal aspect.

Class IV - Canine impacted in the alveolar process between the incisor and premolar.

Class V - Canine impacted in edentulous maxilla.

REMOVAL OF THE IMPACTED TEETH

In surgical removal of impacted tooth, adequate amount of bone should be removed to make the process easy and less time consuming. Excess bone removal leads to difficulty and prolong

wound healing. Tooth sectioning is done for easy removal and with fewer problems. If excess sectioning is done it takes more time. Thus, proper bone removal and tooth sectioning is needed to minimize surgery time and hasten healing.

'Kelsey Fry' is a technique used to remove impacted mandibular third molar.

Steps of Surgical Removal

Step 1: Reflection of adequate flap for accessibility (Fig. 8.23A).

Step 2: Removal of overlying bone (Fig. 8.23B).

Step 3: Sectioning of the tooth (Fig. 8.23C)

Step 4: Delivery of the sectioned tooth with elevator (Fig. 8.23D).

Step 5: Wound debridement and closure (suturing).

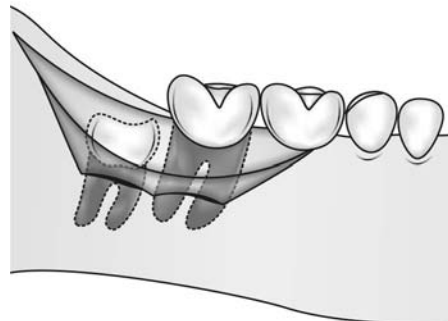


Fig. 8.23A: Step 1- Flap reflection

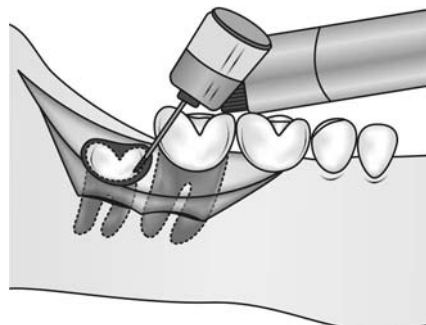


Fig. 8.23B: Step 2- Bone removal

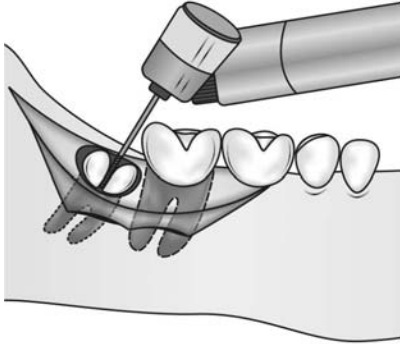


Fig. 8.23C: Step 3- Sectioning of tooth

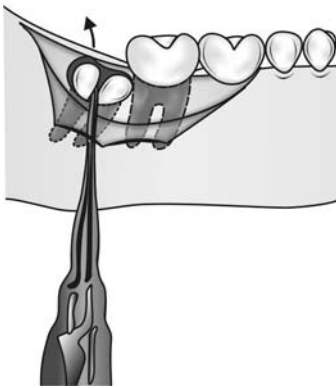


Fig. 8.23D: Step 4- Delivery of tooth

Step 1: *Reflection of adequate flap for accessibility:* Overlying tissue must be removed for accessibility and visibility and muco-periosteum flap must be reflected for easy placement and stabilization of instruments.

Types of Flaps and Incision

1. Envelop flap: This is most preferred as it is easy to close postoperatively and better healing is there.
2. Releasing incision on envelop flap: This is done for greater accessibility and visibility.
3. Three-cornered flap: This is less preferred as poor healing is there but it provides better accessibility.

All the flaps are reflected in such a manner that they are closed over solid bone. Thus, incision is extended to one tooth on either side.

Reflection of flap in impacted Mandibular 3rd molar: Envelop flap is reflected from mesial papilla of mandibular first molar, moving around the neck of the tooth till the distal papilla of second molar and then running posteriorly and laterally till the anterior border of the mandible to approximate the external oblique ridge (Fig. 8.24). The incision should never continue posteriorly in straight line as it may damage the sublingual space and the lingual nerve. Releasing incisions may be needed for deeply embedded tooth (Fig. 8.25).

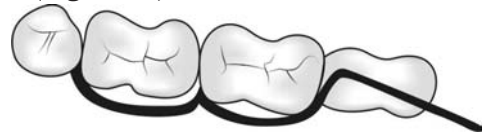


Fig. 8.24: Incision extended posteriorly and laterally

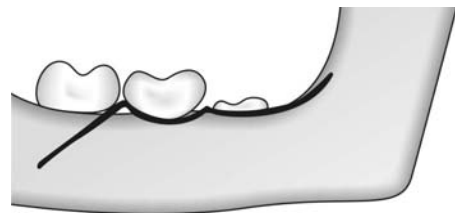


Fig. 8.25: Releasing incision

Reflection of flap in impacted maxillary 3rd molar: Envelop flap is reflected from mesial aspect of first molar posteriorly till distobuccal aspect of second molar (Fig. 8.26). Releasing incision may be made from mesial aspect of second molar for deeply embedded tooth (Fig. 8.27).

Reflection of flap in impacted maxillary canine: For buccally placed canine trapezoidal or semi lunar flaps are reflected with anterior releasing incision.



Fig. 8.26: Incision for maxillary 3rd molar impaction



Fig. 8.27: Releasing incision

For palatally placed canine flap is reflected on the gingival side from mesial side of first molar till canine on the other side (for unilateral cases) (Fig. 8.28) and till mesial side of first molar on other side (for bilateral cases).

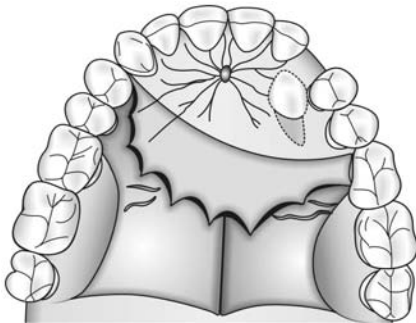


Fig. 8.28: Flap reflection in unilateral impacted maxillary canine

Step 2: Removal of overlying bone: Removal of the bone covering the impacted tooth should be done in the following sequence:

- i. First of all, the occlusal aspect removal should be done to expose the tooth (Fig. 8.29).
- ii. Then the Buccal aspect of the bone should be removed till the cervical margin of the tooth (Fig. 8.30).
- iii. Then, bone between the tooth and the cortical bone should be removed to provide better access. This process is known as 'Ditching'.

Purchase points are made on the tooth for better elevation of tooth.

Precaution must be taken not to remove any bone from the lingual side, to prevent lingual nerve damage in case of lower 3rd molars impaction. The depth of bone removal depends on the depth of impaction, morphology of roots and angulations of tooth.

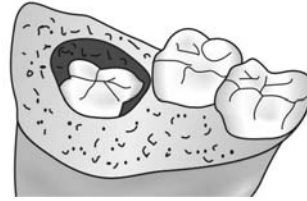


Fig. 8.29: Occlusal bone removed to expose tooth

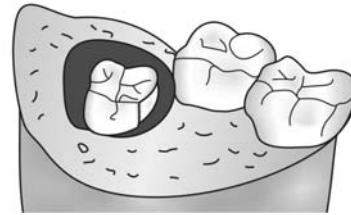


Fig. 8.30: Buccal bone removed

Step 3: Sectioning of the tooth: Sectioning of tooth depends on the angulations of tooth and also divergent roots and the depth of impaction. Sectioning is first done by bur and then broken with the help of straight elevator, so as to prevent damage to the lingual nerve.

Sectioning of impacted Mandibular 3rd molar: The sectioning of various impacted Mandibular 3rd molar tooth is explained below and its removal is done according to the numbering.

Mesioangular impaction: The distal aspect of the crown is sectioned from the tooth. First the distal portion (1) is removed, followed by the mesial portion (2) of the tooth. It is the easiest to remove (Fig. 8.31).

Horizontal impaction: The distal portion of the crown is sectioned first (1) then the distal part (2) of the root followed by the mesial (3) portion of the tooth (Fig. 8.32).



Fig. 8.31

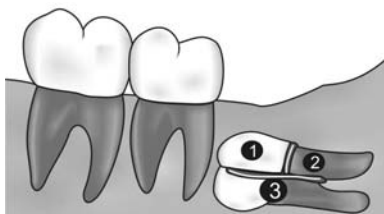


Fig. 8.32

Vertical impaction: The tooth is sectioned into mesial and distal half; first the distal half (1) is removed then the mesial half (2) (Fig. 8.33).



Fig. 8.33

Distoangular impaction: The crown of the tooth (1) is removed first, then either tooth roots {(2) + (3)} are removed together or first distal (2) removed followed by mesial (3) (Fig. 8.34).



Fig. 8.34

Sectioning of impacted maxillary 3rd molar: In case of impacted maxillary 3rd molar sectioning is generally not needed as bone is thin and elastic. In order patients, where bone is thick and inelastic, then generally bone is removed and thus rarely needs sectioning. If sectioning is done then only bur is used, as use of chisel may be injurious and can damage the sinus. Sectioning should be done along the cervical line.

Sectioning in impacted canine: Sectioning of impacted maxillary or Mandibular canine is done along the cervical margin.

Step 4: Delivery of the sectioned tooth with elevator: The sectioned tooth is removed from the bone with the help of elevator. Excess force should not be applied by the elevator but just

enough to lift the tooth, as impacted tooth are weak. The periodontal ligament of impacted tooth are weak, as they do not receive occlusal forces, hence it is easily removed.

Most commonly used elevators for delivering the impacted tooth are:

- Straight elevator
- Paired Cryer elevator
- Crane pick elevator

The curved elevators, used for gaining access are:

- Pott's elevator
- Miller's elevator

Step 5: Debridement of wound and wound closure: Debridement of the wound is done by:

- Removing the bone chip and debris from the wound.
- Periapical curettage
- Using bone file to smoothen the sharp bony edges.
- Irrigating with sterile saline.
- Control of bleeding.

Wound closure should be done by placing 3-4 sutures for envelop flap and if releasing incision is made then 1 more additional suture is placed. Moist pressure packs should be given.

Postoperative Instructions

It is similar to that discussed under 'Exodontia'.

Complications

It is similar to that discussed under 'Exodontia'.

FURTHER READING

1. Archer WH — Oral and maxillofacial surgery 5th ed. Vol. 1.
2. Eisele — Complications in head and neck surgery.
3. Gustav O Kruger — Textbook of oral and maxillofacial surgery, 6th ed.
4. Howe GL — Minor oral surgery, 3rd ed, 1996.
5. Killey HC, Seward GR, Kay LW — An outline of oral surgery, Part I, 1st ed, 1983.
6. Peterson, Ellis, Hupp, Tucker — Contemporary oral and maxillofacial surgery, 4th ed, 2006.
7. Waite DE — Textbook of practical oral and maxillofacial surgery, 3rd ed, 1987.

Infection of the Orofacial Region

9

INTRODUCTION

Infection is the invasion of the body by harmful organism (pathogens), such as bacteria, fungi, protozoa, rickettsiae, or viruses. The infective agent may be transmitted by a patient or carrier in airborne droplets expelled during coughing and sneezing or by direct contact, such as kissing or sexual intercourse; by animal or insect - vector; by ingestion of contaminated food or drink; or from an infected mother to the fetus during pregnancy or birth. Pathogenic organism present in soil, organism from animal intermediate hosts, or those living as commensal on the body can also cause infection. Organism may invade via a wound or bite or through mucous membranes.

After an incubation period symptoms appear, usually consisting of either localized inflammation and pain or more remote effects.

Treatment with antibiotics is usually effective against most infections, but there are few specific treatment for many of the common viral infections.

Infections of the head and neck region can be odontogenic (originating from dental and associated structures) and non-odontogenic (originating from other structures).

Odontogenic infections are infectious arising from ameloblasts, pulpal tissues, periodontal tissues, periapical tissues, pericoronal tissues.

Non-odontogenic infections are infectious that invade through the mucosa, skin due to certain iatrogenic or other injurious lesions.

MICROBIOLOGY OF ODONTOGENIC INFECTION

Micro-organism	Percent of incidence present in pulpal and periapical infection
• <i>Streptococci</i> (α and non-hemolytic)	50
• <i>Veillonella</i> sp.	29
• <i>Propionibacillus</i> sp.	20
• <i>Peptostreptococcus</i> sp.	18
• <i>Staphylococci</i>	16
• <i>Bacteriodes</i> sp.	15
• <i>Streptococcus faecalis</i>	13
• <i>Candida albicans</i>	7
• <i>Neisseria</i> sp.	5
• <i>Lactobacillus</i> sp.	5
• <i>Fusobacteria</i>	5
• <i>Proteus</i> sp.	4
• <i>Escherichia coli</i>	4
• <i>Diphtheroids</i>	4
• <i>Actinomyces</i> sp.	4

DISTRIBUTION OF INDIGENOUS MICROORGANISM IN HEAD AND NECK REGION

Organism	Mouth	Oropharynx
Gram + Faculative cocci		
– α - <i>Streptococcus</i>	++++	++++
– β - <i>Streptococcus</i>	+	++
– Nonhemolytic <i>streptococcus</i>	+++	+++
– <i>Pneumococci</i>	+	++
– <i>Staphylococcus Epidermidis</i>	+++	+
– <i>Staphylococcus Aureus</i>	+++	+++
Gram + Anaerobic <i>Streptococcus</i> (peptostreptococcus)	+++	+++
Gram + Faculative Rod		
– <i>Diphtheroids</i>	++++	+++
– <i>Lactobacillus</i>	+++	0
– <i>Actinomyces</i>	+++	+++
Gram + Anaerobic Rod		
– <i>Clostridium</i>	+	0
– <i>Diphtheroids</i>	+++	+++
Gram -ve Faculative coccus		
– <i>Neisseria</i>	+++	+++
Gram -ve Anaerobic cocci		
– <i>Veillonellae</i>	++++	+++
Gram -ve Anaerobic Rods		
– <i>Pseudomonas</i>	+	0
– <i>Coliform Bacteria</i>	+	+
Gram -ve Anaerobic Rods		
– <i>Fusobacterium</i>	+++	+
– <i>Bacteriodes</i>	+++	+
– <i>Spirochaetes</i>	+++	+
– Measles	+++	+++

+ + + + = Major component

+ + + = Minor component

+ + = May be present or minor component

+ = very minor component

0 = absent

SPREAD OF INFECTION (FACTORS CONTROLLING SPREAD OF INFECTION)

I. General Factors

1. Micro organism - quantity and virulence
2. Anatomic considerations - Infection tends to spread through path of least resistance. Barriers are - alveolar bone, periosteum, muscles and fascia.
3. Personal resistance to infection - In patients with AIDS, diabetes, leukaemia etc have low resistance, increase susceptibility to infections.

II. Host Defense/Resistance

1. Local Factor
 - i. Epithelial lining of the skin and mucous membrane
 - ii. Secretion and drainage from the body tissues
 - iii. Normal commensals present in the body
2. Humoral Immunity (Immunoglobulin produced by the B- lymphocytes)
3. Cellular Immunity (phagocytic action of the T- lymphocytes)

SPREAD OF INFECTIONS (ANATOMIC CONSIDERATIONS)

Sl. No.	Involved tooth	Usual exit from bone	Relation of muscle to root apices	Site of localisation	Muscle playing the role in spread
1.	Upper central incisor	labial	above	Oral vestibule	Orbicularis oris + dense C.T at base of nose
2.	Upper lateral incisor	– Labial – Palatal	above	– Oral vestibule – Palatal	Root apex curved palatally
3.	Upper canine	labial	Above or below	Oral vestibule Canine space	Levator Anguli Oris

Contd...

Contd...

Sl. No.	Involved tooth	Usual exit from bone	Relation of muscle to root apices	Site of localisation	Muscle playing the role in spread
4.	Upper premolar	– Buccal – Palatal	above	Oral vestibule Palate	Buccinator muscle
5.	Upper molars	Buccal Palatal	Above or below	Oral vestibule Buccal space Palate (or maxillary sinus)	Buccinator muscle
6.	Lower incisors	labial	Above below	Oral vestibule Submental space	Mentalis muscle
7.	Lower canine	labial	Below	Oral vestibule	
8.	Lower premolars	buccal	Below	Oral vestibule	
9.	Lower 1st molar	Buccal lingual	Below Above Below	Oral vestibule Buccal space Sublingual space	Buccinator muscle Buccinator muscle Mylohyoid muscle
10.	Lower 2nd molars	Buccal Lingual	Below Above Below Above	Oral vestibule Buccal space Sublingual space Submandibular space	Buccinator muscle Buccinator muscle Mylohyoid muscle Mylohyoid muscle
11.	Lower 3rd molar	lingual	Above	Submandibular or Pterygomandibular space	Mylohyoid muscle

* "Spread of infection is always along the path of least resistance"

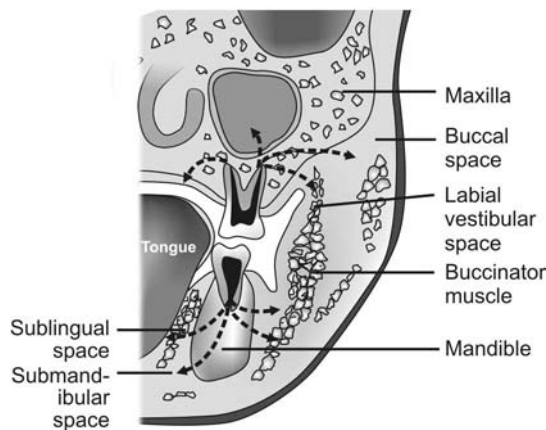


Fig. 9.1: Pathway of the spread of infections

SPREAD OF INFECTION FROM MANDIBULAR 3RD MOLAR

In mandibular 3rd molar, the roots are near lingual plate, Therefore buccal palate perforation is not seen.

Generally, infection spreads to submandibular space and if it spreads beyond the posterior extent of the mylohyoid muscle (seen in cases of musio-angular or horizontal impaction), infection goes to pterygomandibular space leading to paraesthesia and swelling of the area.

If infection spreads medial to medial pterygoid muscle then it reaches the parapharyngeal spaces (Fig. 9.2).

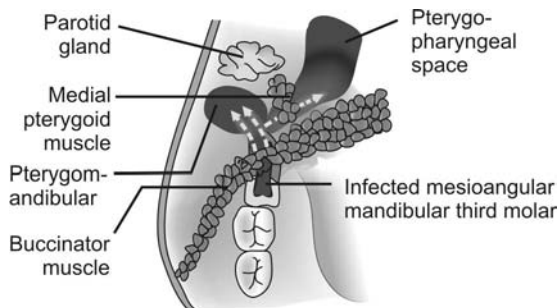
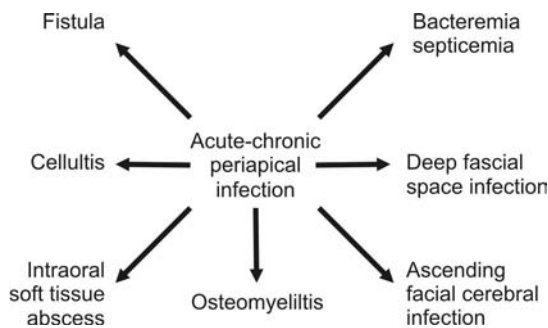


Fig. 9.2: Spread of infection from infected mandibular third molar

PATHWAY OF DENTAL INFECTION



ODONTOGENIC INFECTION (GENERAL STUDY)

Clinical Features (Signs and Symptoms)

1. Mild Infection

- Trivial → Inflammatory sign
 - Dolor
 - Calor
 - Rubor
 - Tumor
 - Loss of function
- Lymphadenopathy
- Pyrexia (fever)

2. Severe Infection

- Trivial + signs of toxicity
 - Paleness
 - Rapid respiration
 - Rapid thrombing pulse
 - Shivering
 - Fever
 - Lethargy
 - Diaphoresis (severe sweating)

3. Extreme Infection

- Trivial + sign of toxicity + CNS changes
 - Impaired eye movement/vision
 - Decreased level of consciousness
- Meningeal irritation (severe headache, stiff neck, vomiting)
- Edema of eyelids
- Airway compromise
- Difficulty in swallowing

Diagnosis

Lab Studies

- Uncomplicated abscess: No laboratory studies are required.
- Complicated abscess:
 - The CBC count may reveal leukocytosis with neutrophil predominance.
 - Obtain a blood culture (aerobic and anaerobic) before initiating parental antibiotic.
 - Needle aspiration is indicated for gram stain and culture.

Imaging Studies

- Uncomplicated abscess: No imaging studies are required.
- Complicated abscess:
 - Plain radiography represents the first level of investigation because it is readily available.

- Lateral and anteroposterior neck views may reveal a soft tissue neck mass that reveals abscess.
- Panoramic radiograph (pantomography) is helpful to indicate whether bone or teeth is involved.
- C.T scan with intravenous contrast is the most accurate method to determine the local relationship of the inflammatory process to the surrounding vital structures.

PROCEDURES

Aspiration

- Confirm presence of the abscess via needle aspiration.
- If pus is obtained, do not aspirate more than 1 or 2 drops. Leave the abscess as later, area is easier to find for further management.
- If pus cannot be aspirated, manage medically until a more localized infection develops.
- Incision and drainage may be performed only if pus can be aspirated.
- Packing a periapical abscess is generally not necessary.

Differential Diagnosis

Three stages in progression of acute odontogenic infection:

1. Periapical Osteitis or Apical periodontitis - infection confined within alveolar bone
2. Cellulitis - Infection spreads through bone, periosteum into soft tissue
 - No suppuration.
3. Stage of Abscess formation - Suppuration and localization within 72 hours of cellulitis.

Treatment

Medical Care

- Assess the airway upon respiratory distress, oropharyngeal tissue swelling or inability to

secure the airway via endotracheal intubation or tracheostomy.

- Properly collect specimen for gram stain and culture.
- Administer empiric antibiotic therapy.
- Administer analgesia.
- Hydrate the patient and use of treatment agent. (Hot packs are contraindicated in case of cellulitis as can lead to abscess)

Surgical Care

- The primary therapeutic modality is surgical drainage of any pus collection. Incision and rupture of the abscess quickly accelerates resolution of the infection. Abscess should be drained even if patient is toxic, since toxemia usually results from the absorption of degenerated tissue products and bacterial toxins.
- Emergent surgery is indicated in the operating room if the airway is threatened or if the pulse is deteriorating.

Consultations

- Consult a dentist if the patient has an uncomplicated abscess.
- Consult a maxillofacial oral surgeon if the patient has a complicated abscess.

Diet

Diet is as tolerated. However, a soft bland diet is usually preferred.

Activity

Activity is as tolerated.

TREATMENT OF ODONTOGENIC INFECTION

Treatment of odontogenic infection depends on:

- a. Stage of infection
- b. Physiologic response of the patient.

Sl. No.	Stage of infection	Response to infection	Suggested treatment
1.	Periapical Osteitis		
	a. Infection confined within the bone	Non- toxic	Prophylactic antibiotic and extraction of tooth
	b. Tooth extruded from socket	Toxic (elevated temperature > 38° C, Chills, swelling.	Open pulp chamber and give supportive care.
	c. Tooth painful to biting or percussions	Malaise, anorexia, W.B.C etc)	(antibiotic, analgesic, hot application until patient is no longer toxic)
2.	Cellulitis		
	a. Swelling not sharply demarcated	Non-toxic	Prophylactic antibiotic and extraction of the involved tooth.
	b. Tissue have doughly consistency	Toxic	Open pulp chamber and give supportive care until patient is non-toxic.
	c. No fluctuation		
3.	Abscess		
	a. Swelling distinctly outlined	Non-toxic	Evaluation of pus by incision drainage and/or extraction of involved tooth.
	b. Tooth have firm, consistency	Toxic	Prophylactic antibiotic and drainage by incision and drainage and/or extraction
	c. Fluctuation elicited.		

Note: If tooth to be conserve by RCT, pulp chamber should be opened.

PRINCIPLES FOR THE USE OF PROPHYLACTIC ANTIBIOTICS

1. The operative procedure must have a risk of significant bacterial contamination and a high incidence of infection.
2. The organism most likely to cause the infection must be known.
3. The antibiotic susceptibility of the causative organism must be known.
4. To be effective and to minimize adverse effects, the antibiotic must be in the tissue at the time of contamination (operation), and it must be continued for no more than four hours after cessation of contamination.
5. The drug must be given in dosages sufficient to reach four times the MIC of the causative organism (MIC = Minimum inhibitory concentration of an antibiotic for a specific bacteria).

PRINCIPLES FOR THE USE OF THERAPEUTIC ANTIBIOTICS

1. Identification of the causative organism.
2. Determination of the antibiotic sensitivity
3. Use of specific, narrow- spectrum antibiotics
4. Use of least toxic antibiotic.
5. Patient drug history.
6. Use of bacteriocidal rather than bacteriostatic drugs.
7. Use of antibiotics with a proven history of success.
8. Cost of antibiotics.

Common Antibiotic Regime Used

- Amoxycillin 3 gm, 1 hr prior to procedure + Amoxycillin 1.5 gm, 6 hr after initial dose.

- For children,
Amoxycillin 15 mg/kg, 1 hr before procedure
+ Amoxycillin half initial dose, 6 hr after initial dose.
- In penicillin sensitive patients,
Erythromycin or clindamycin.
- In case of parenteral usage,
Ampicillin, clindamycin, gentamycin or
vancomycin.

PRINCIPLES OF INCISION AND DRAINAGE

1. Knowledge of local anatomy of the area to be incised.
2. Incision should be made in the most dependent area. (Incision should not be made in centre as causes necrosis and scarring)
3. Wide incisions for drainage (has technical and esthetic problems).
4. Incision placed in esthetically accepted area.
 - Parallel to the skin folds or shadow of mandible.

“Hilton's method of abscess drainage”

Closed blades of sinus forceps are thrust through the incision and into the abscess, ensures that no blood vessel or nerve is damaged.

Causes For The Failure in Treatment of Infection

- Inadequate surgical treatment
- Depressed host defenses
- Presence of foreign body.
- Antibiotic problems:
 - Drug not reaching infection
 - Dose not adequate
 - Wrong bacterial diagnosis
 - Wrong antibiotic

INFECTION OF THE PULPAL AND PERIAPICAL TISSUES

Etiology

1. Physical
 - A. mechanical
 - i. accidental
 - ii. iatrogenic
 - iii. pathological
 - iv. aerodontalgia
 - B. Thermal
 - i. heat
 - ii. friction
 - iii. cold
2. Chemical
3. Bacterial
 - i. caries
 - ii. plaque
 - iii. anachoretic pulpitis

STUDY OF SOME PULPAL AND PERIAPICAL INFECTIONS

Focal Reversible Pulpitis or Pulpal Hyperemia

It is an early, mild, transient pulpitis localized chiefly to the pulpal ends of the irritated dental tubules.

Features

- Tooth is sensitive to thermal changes specially cold.
- Hyperactive to electrical changes.
- Clinically visible deep caries or large metallic restoration.
- Pain can be elicited which subsides after a transient period.

Chronic Hyperplastic Pulpitis or Pulp Polyp

It is an excessive exuberant proliferation of chronically inflamed dental pulpal tissues.

Features

- Exclusively seen in children and young adults.
- Clinically visible large open carious lesion, pinkish red globular tissue seen protruding from pulp chamber.
- Generally insensitive to touch but may bleed on manipulation.
- Should be carefully differentiated from gingival proliferation.

Acute Pulpitis

It is an extensive reversible or irreversible acute infection of the dental pulp.

Features

	<i>Reversible pulpitis</i>	<i>Irreversible pulpitis</i>
History	Slight sensitivity or occasional pain	Constant or intermittent pain
Pain	Momentary and immediate, sharp in nature, dissipates after removal of stimulus	Continuous delayed onset, throbbing persists for minutes to hours after removal of stimulus
Location	Localized	Not localized
Change of posture	No difference	Pain increases
Thermal test	Responds immediately	Delayed response
Electric pulp test	Early response	Early, delayed or mixed response.
Percussion	Negative	Negative in early stages, later positive when periapex involve.
Radiograph	Negative	May show widening of PDL spaces.

Apical Periodontal Cyst or Periapical Cyst (Radicular Cyst, Bay Cyst)

It is a sequence of periapical granuloma caused due to necrosis of pulpal tissues. A true cyst is a pathological cavity lined by epithelial or non-epithelial tissues and is often filled with fluid.

Features

- Generally asymptomatic but may show mild pain or sensitivity on percussion.
- Extraoral and/or intraoral swelling with or without expansion of cortical plates may be there.
- May lead to abscess, cellulites or even fistula.

Chronic Apical Periodontitis or Periapical Granuloma

It is a localized mass of chronic granulation tissues associated with the root of an infected tooth or teeth.

Features

- Sensitivity with mild or severe pain is felt which can be localized on percussion or while chewing.
- Extrusion of tooth from socket may be there.
- Inflammation, edema and swelling can be seen intra and extraorally.

Periapical and Periodontal Abscess

Features

<i>Features</i>	<i>Periapical abscess</i>	<i>Periodontal abscess</i>
Cause	Pulpal infection	Periodontal infection
Pain	Severe and throbbing	Severe and throbbing
Swelling	In mucobuccal region, usually near apex of involved tooth	In attached gingiva.
Tenderness to percussion	Present	Present
Sinus discharge	May be present	May be present
Mobility	Seen at later stages	Seen even at earlier stages
Pocket	Single and narrow	Multiple, wide coronally
Pulp	Necrotic and infected	Vital
Radiographic feature	Localized bone loss which is mostly horizontal and more near the apex of tooth	Generalised bone loss which is mostly vertical and more near the coronal portion of the tooth
Treatment	Root canal therapy or extraction	Periodontal Intervention.

SPACES INVOLVED IN ODONTOGENIC INFECTIONS

1. Primary Spaces

A. MAXILLARY

- i. Canine space
- ii. Buccal space
- iii. Infratemporal space

B. MANDIBULAR

- i. Submental space
- ii. Submandibular space

iii. Sublingual space

iv. Buccal space

2. Secondary Spaces

- a. Masseteric space
- b. Pterygomandibular space
- c. Superficial and deep temporal space
- d. Lateral pharyngeal space
- e. Retropharyngeal space
- f. Prevertebral spaces
- g. Parotid space

PRIMARY MAXILLARY SPACES

Spaces	Canine fossa/ Infraorbital space	Buccal Space	Infratemporal Space
i. Location/Boundaries			
• Superiorly	Infraorbital ridge	Zygomatic Arch	Zygomatic arch and infratemporal surface of greater wing of sphenoid.
• Inferiorly	Canninus muscle	Lower border of mandible	Lateral pterygoid muscle
• Anteriorly	Orbicularis oris	Orbicularis Oris, Zygomaticus major, muscle over Ramus	Infratemporal surface of maxilla
• Posteriorly	Buccinator muscle	Masseter muscle over ramus	Parotid gland
• Medially	Anterolateral surface of maxilla	Buccinator muscle and masseter muscle overlying anterior border of ramus.	Medial pterygoid plate, lateral pterygoid muscle, medial pterygoid muscle, lower part of temporal fossa and lateral wall of pharynx.
• Laterally	-----	Skin, subcutaneous tissue and platysma	Ramus of mandible and temporalis muscle.
ii. Contents	-----	Buccal pad of fat, stenson's duct, facial artery.	Medial pterygoid muscle, lateral pterygoid muscle, pterygoid plexus of vein, maxillary artery, mandible nerve, middle meningeal artery.
iii. Features	Infection spreads from maxillary cuspid and from nasal infection. Swelling of cheek and upper lip. Obliteration of nasolabial fold, drooping of angle of mouth, odema of lower eyelid.	Infection spread from maxillary and mandibular premolars and molars Gum boil or prominent E/O swelling from infraorbital region till lower border of mandible	Trismus Swelling of area and difficult to open eye

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Spaces	Canine fossa/ Infraorbital space	Buccal Space	Infratemporal Space
iv. Surgical treatment (incision and drainage)	Approached through the mucosa of buccal vestibule in region of lateral incisor and canine.	Approached through cheek mucosa by horizontal incision near premolar and molar region	Approached I/O from buccal vestibule opposite to 2nd and 3rd molar. Approached E/O at the upper and posterior edge of temporalis muscle within the hairline.

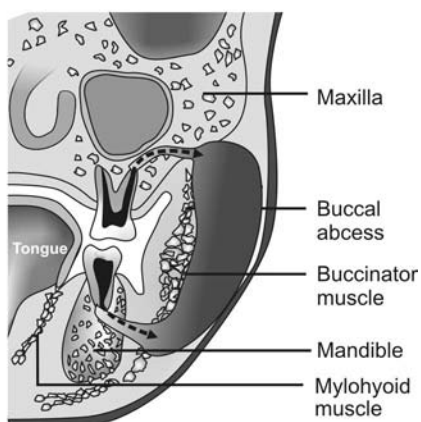


Fig. 9.3: Spread infections to buccal space

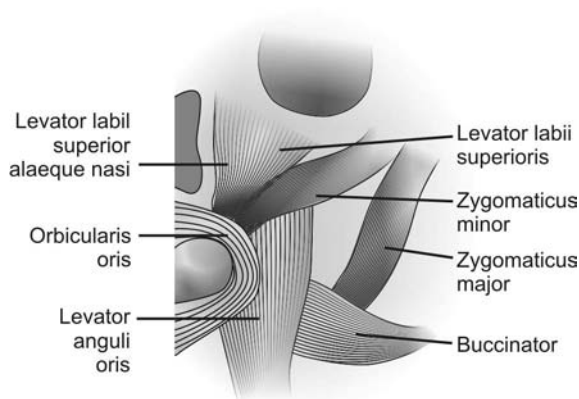


Fig. 9.4: Canine space and its boundaries

PRIMARY MANDIBULAR SPACES

Spaces	Sublingual space	Submandibular space	Submental space
i. Location/boundaries			
Superiorly	Mucosa or oral cavity	Medial aspect of mandible and the attachment of mylohyoid muscle.	Mylohyoid muscle.
Inferiorly	Mylohyoid muscle	Anterior and posterior bellies of digastric	Suprahyoid portion of deep cervical fascia.
Anteriorly	Lingual aspect of mandible	Anterior belly of digastric and mylohyoid muscle.	---
Posteriorly	At the midline, by body of hyoid bone.	Floor is formed by hyoglossus muscle.	---
Medially	Geniohyoid, genioglossus and styloglossus muscle	Mylohyoid, hyoglossus and styloglossus muscle.	---

Contd...

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Spaces	Sublingual space	Submandibular space	Submental space
Laterally	Lingual aspect of mandible	Skin, superficial fascia, platysma and superficial layer of deep cervical fascia.	Lower body of mandible of mandible and belly of digastric.
ii. Contents	Geniohyoid, genioglossus, hyoglossus muscle. Also contain submandibillar salivary gland and duct, sublingual salivary gland, lingual nerve and hyoglossal nerve.	Superficial lobe of submandibular salivary gland, submandibular lymph node, facial artery and vein.	Submental lymph nodes and anterior jugular veins.
iii. Features	- Infection spreads from mandibular anteriors, premolars and 1st molar. - Extra orally, No swelling - Intra oral, painful firm swelling in floor of mouth. - Pain, discomfort in deglutition, airway obstruction and affected speech.	- Infection spreads from mandibular molars or secondary from sublingual space. - Firm, extraoral swelling below inferior border of mandible. - Tenderness, dysphagia, trismus and sensitivity of teeth to percussion.	- Infection spreads from mandibular anterior teeth. - Distinct firm extraoral swelling along the midline beneath the chin. - Mobility and tenderness on percussion of teeth.
iv. Treatment (incision and drainage)	- Bilateral intraoral incision is made through the mucosa, parallel to wharton's duct at the base of alveolar process.	Bilateral through and through incisions made along the shadow of mandible through the skin, superficial fascia blunt dissection through platysma	A blunt dissection is carried out by making a transverse incision in skin below the symphysis of mandible.

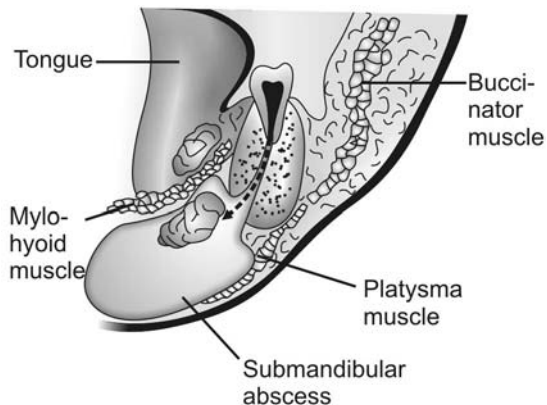


Fig. 9.5: Spread of infection to submandibular space

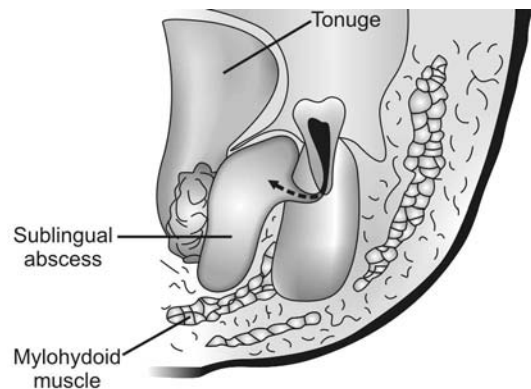


Fig. 9.6: Spread of infection to sublingual space

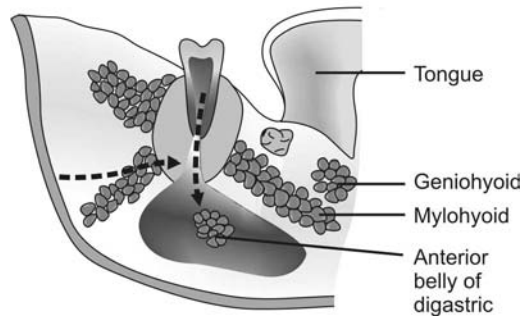


Fig. 9.7: Spread of infection of submental space

MASTIGATORY SPACES

Spaces	Sub-masseteric space	Pterygomandibular space	Temporal space (superficial and deep)
i. Location/Boundaries			
• Superiorly	Zygomatic Arch	Lateral pterygoid muscle.	Superficial temporal pouch in between temporal fascia and temporalis muscle.
• Inferiorly	Masseteric muscle attachment on the mandible.	-----	
• Anteriorly	Anterior border of masseteric muscle and Buccinator and fascia of parotid gland.	Pterygomandibular Raphe.	Deep temporal pouch lies between temporal muscle and skull.
• Posteriorly	Parotid gland and posterior aspect of masseter.	Parotid gland.	-----
• Medially	Lateral aspect of Ramus of mandible.	Lateral aspect of medial pterygoid muscle.	-----
• Laterally	Medial border of masseter muscle.	Medial surface of Ramus.	-----
ii. Contents	Muscles of mastication (masseteric, lateral and medial pterygoid and temporalis) Ramus of mandible. Buccal nerve, inferior alveolar nerve.	Lingual nerve mandibular nerve, Inferior alveolar nerve Mandibular artery Mylohyoid nerve and vessels. Loose connective tissue.	Communicates directly with infratemporal and pterygopalatine fossa.
iii. Features	Infection spreads through lower 3rd molar Tenderness and severe pain in ramus region. Trismus and swelling extends from lower border of mandible to zygomatic arch.	Infection spreads from mandibular 3rd molar, and also from maxillary 3rd molar after contaminated. Inferior alveolar nerve block. No E/O swelling Tenderness dysphagia. Oedema in 3rd molar area.	Pain and trismus. Swelling over the temporal region.

Contd...

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Spaces	Sub-masseteric space	Pterygomandibular space	Temporal space (superficial and deep)
iv. Surgical treatment (Incision and drainage)	Extra oral is mostly used in case of trismus in skin behind angle of mandible. Intraoral vertical incision is placed over lower part of anterior border of ramus.	Extraoral incision is made in skin below angle of mandible. Intraoral vertical incision is made on anterior and medial aspect of ramus of mandible.	Extra oral incision in temporal region, which should be above hair line and 45° to zygomatic arch.

*Masticatory space infection usually results from-

- Infection of the last two molars
- External or internal trauma to the mandibular angle region
- Non aseptic technique in LA

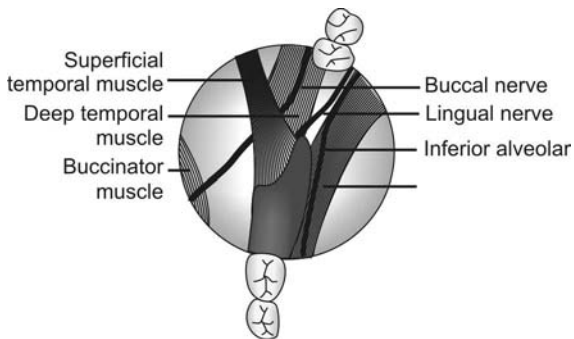


Fig. 9.8: Pterygomandibular space and its boundaries

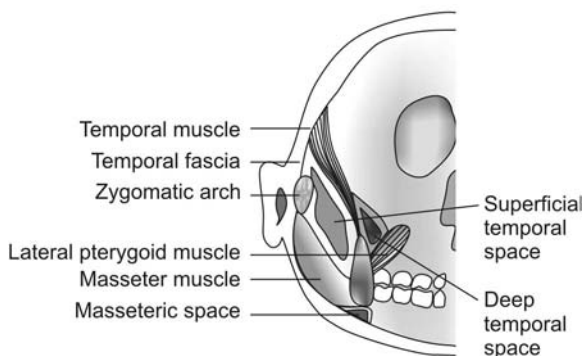


Fig. 9.9: Masticatory space and boundaries

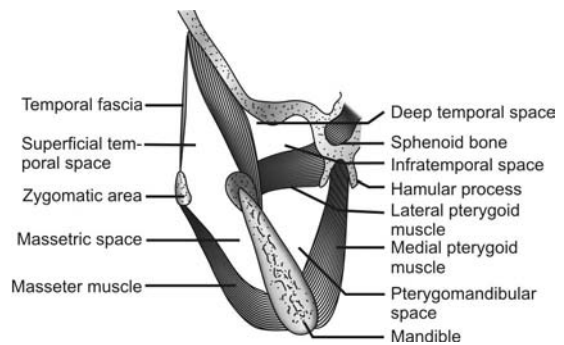


Fig. 9.10: Secondary spaces and its boundaries

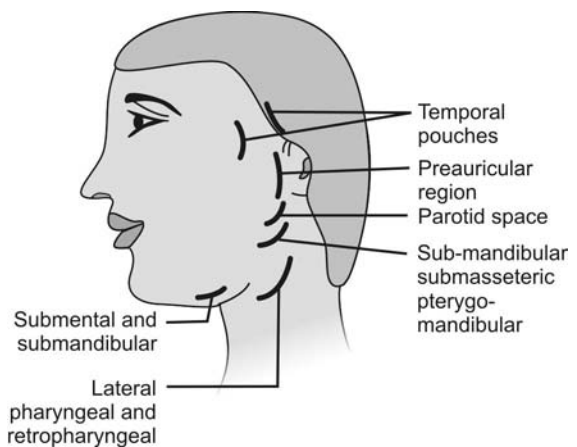


Fig. 9.11: Site for extra oral incisions to drain abscess

LUDWIG'S ANGINA

Angina is choking or suffocating sensation. Ludwig's Angina is a firm, acute, toxic cellulitis involving bilaterally the sublingual, submandibular and submental spaces.

Etiology

- Infections of mandibular molars
- Postextraction complication
- Compound mandibular fractures.
- Submandibular gland sialadenitis
- Oral soft tissue lacerations.

Microbiology

- Streptococcal infections or mixed flora
- Reports also show the presence of *Staphylococci*, *E.Coli*, *Pseudomonas* and certain anaerobes.

Pathogenesis

According to many authors, like Kruger, Topazian and Ludwig, the infection starts in submandibular space and later spreads, but by this it is difficult to explain the pathogenesis. Hence, Laskin tells that the infection starts at the sublingual space and spreads bilaterally extending posteriorly over mylohyoid muscle to involve the submandibular and submental spaces at a later stage. Further more, the infection spreads to the pharyngeal spaces and the mediastenum (Fig. 9.12).

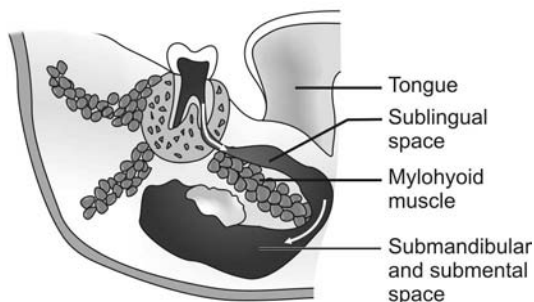


Fig. 9.12: Spread of infection in Ludwig's angina

Features

- Always involves all the three - sublingual, submandibular and submental spaces bilaterally
- Rapidly developing board-like, brawny, firm, indurated, diffused, non-fluctuating swelling in the floor of the mouth which shows no pitting on pressure (Fig. 9.13).
- Discomfort and pain while eating, swallowing, breathing, speaking and chewing.
- Characteristic 'OPEN MOUTH' Appearance with elevated, protruded tongue and elevated floor of mouth.
- Toxic signs of high fever, rapid pulse, chills, rigor, excessive salivation, trismus and angina.
- As infection continues, edema of tongue increases and there is high risk of death due to suffocation

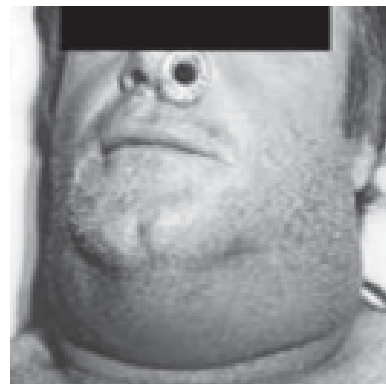


Fig. 9.13: Clinical view of a patient suffering from Ludwig's angina (For color version see plate 2)

Treatment

1. General management of infection is manifested to destroy or inhibit bacterial growth and to increase the physiological defense mechanism of patient.
 - Bed rest is advised, along with hydration.
 - Empirical antibiotics should be administered.

- Airway potency and vital sign management. (may need tracheostomy-Laryngotomy and Cricothyroidotomy/Tracheotomy are more preferred)
 - Heat and cold therapy (apply moist heat over the area for 20-30 min/hour).
2. Surgical intervention is instituted for releasing tissue tension and for pus drainage. Incisions are made separately for submandibular, sublingual and submental spaces as explained earlier and the pus is collected which is inturn send for gram stain, culture and antibiotic sensitivity test. An artery forcep or Hilton's forcep is thrust through the incision and a drain is fixed to enable complete clearing of pus. (Hilton's method of Abscess drainage)-sublingual and submental space can be approached through the incision line made for the submandibular space, but this is not preferred, as here excision of submandibular muscle has to be done.

Prognosis

If not treated early and efficiently can lead to death due to aspiration causing severe sepsis.

COMPLICATIONS OF ODONTOGENIC INFECTION

1. Cavernous Sinus Thrombosis

It is a septic thrombosis of cavernous sinus caused due to an infection in the orofacial region, like sinusitis, abscess or cellulitis of the orbit, upper lip, nose, maxilla or dental tissues. The classical dangerous area of the face (Triangular area having its base as the upper lip and its apex as the root of nose) has valveless venous drainage which empty itself into the cavernous sinus thus making it easier for any infection of the region to enter into the sinus.

Features

- Suddenly occurring, widely spreading and severe in nature.

- Fever, nausea, vomiting, chills, rigor, stiffness and constitutional symptoms.
- Tender and painful eye, paralysis of the extraocular muscles (ophthalmoplegia), edema of eyelid, proptosis, and conjunctivitis.

Investigations

Mainly diagnosed by the clinical features along with skull radiograph, C.T Scan, M.R.I and CSF examination.

Treatment

- Immediate empirical antibiotic therapy like I.V- chloramphenicol, Aminoglycosides, Trimethoprim, Sulphamethazole.
- In case of abscess surgical drainage via craniotomy procedure is done.
- Emergency neurosurgical intervention is required.

Prognosis

Invariably fatal whereby death occurs due to brain abscess or meningitis.

2. Brain Abscess

It is the second most common neurological complication, after meningitis of head and neck infections, occurring from bacterimia accompanying odontogenic infections.

Features

- Inflammation, localized edema with septic thrombosis and abscess may develop.
- Headache, nausea, vomiting, chills, rigor, fever.
- Sometimes headache is the only symptoms present.
- Papilledema
- Hemiplegia and hemianopsia
- Convulsion and abberant nerve palsy.
- Stupor, confusion and subtle change in personality is also seen.

Treatment

- Antibiotic therapy (I.V - chloramphenicol) along with steroid (Dexamethazone and mannitol).
- Lumbar puncture if meningitis is suspected.
- Surgical drainage of abscess by craniotomy.

3. Meningitis

It is the most common neurologic complications in orofacial infections whereby bacteria infect the arachnoid mater, pia mater and CSF.

Features

- Headache, fever, nausea, vomiting, chill, rigor.
- Pain and stiffness of neck and back.
- Confusion, stupor, seizure and coma.
- Kernig's sign positive (strong resistance is felt when an attempt is made to extend the knee from flexed thigh position)
- Brudzinski's sign positive (abrupt neck flexion in supine patient resulting in involuntary flexion of knee).

Treatment

- Lumbar puncture is done and CSF is collected for examination.
- Antibiotic therapy is preferred to surgical intervention.

4. Mediastenitis

It is an extension of infection from deep neck spaces into the mediastenum, which is caused as a very late complication thereby causing chest pain, dyspnea, unremitting fever and characteristic mediastenal widening in radiograph. The condition is treated by long term antibiotic therapy and surgical drainage of mediastenum.

PERICORONITIS

It is a infection of the operculum covering the partially erupted permanent teeth specially the mandibular 3rd molar.

Predisposing factors of the condition

- Improper oral hygiene
- Occlusal trauma
- Gingival infection
- Food lodgment
- Reduced body resistance.

Types of Pericoronitis

Pericoronitis can be classified into 3 types depending upon the features present:

- i. Acute: Here all the classical features are present
- ii. Subacute: Here the classical symptoms have subsided but certain signs are still present along with the presence of a sinus tract.
- iii. Chronic: Here most of the features have subsided but a distinct fistulous tract is present.

Features

- Crypt like area is formed between the tooth and operculum which favours food and debris lodgement and thus microbial proliferation (Fig. 9.14).
- Severe localized or radiating pain.
- Distinct extraoral and/or intraoral swelling near the angle of mandible of the affected side and/or opposite to 3rd molar respectively.
- Submandibular lymphadenopathy and lymphadenitis.



Fig. 9.14: Clinical view of pericoronitis
(For color version see plate 2)



Fig. 9.15: Radiographic view of pericoronitis
(For color version see plate 2)

- Fever, malaise, increased pulse rate, increased respiratory rate, dysphagia.
- Sloughing and ulceration of operculum, halitosis and trismus.
- Fistulous tract which may or may not be draining may be seen.

Treatment

- In case of Acute Pericoronitis, general management of an odontogenic infection - complete bed rest, soft nutritious diet and proper oral hygiene with use of mouth rinses, is advised.
- Proper use of antibiotic and analgesic should be instituted - Penicillin, Doxycycline, and Metronidazole is preferred.
- Thorough debridement of tissues with chlorhexidine irrigation and hot saline mouth wash.
- In certain cases, surgical excision of the operculum - operculectomy (Fig. 9.17) or use of caustic agents or electrocautery with or without extraction of the offending, opposing maxillary tooth is advised.
- In case of chronic Pericoronitis, proper antibiotic and analgesic with or without extraction of offending, opposing maxillary tooth is recommended.

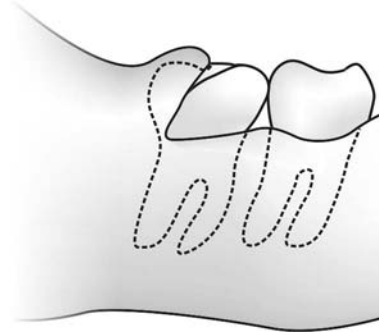


Fig. 9.16: Pericoronitis

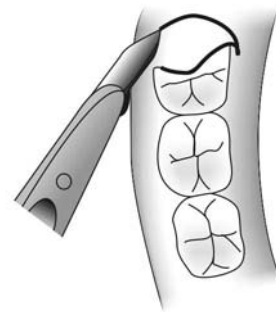


Fig. 9.17: Operculectomy

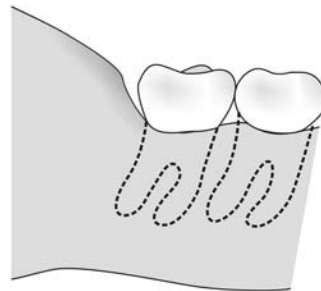


Fig. 9.18: Postoperative

PERITONSILLAR ABSCESS (QUINSY)

It is a localized infection of the tissues between the tonsils and superior constrictor muscles and between the anterior and posterior pillars of fauces.

Features

- Infection spreads from an acute pericoronal abscess which is present near the tonsils or from an infection near the supratonsillar fossa.
- Pain near the throat and ear of the affected side.
- Fever, dysphagia, trismus, drooping of saliva, altered speech, and difficulty in swallowing.

Treatment

General management of an infection with soft diet and proper antibiotics and analgesics are recommended. Surgical drainage by an incision into the most prominent part of the soft palate to drain the abscess.

If not treated properly severe oedema affecting the tongue and epiglottis may occur which may even lead to death.

FURTHER READING

1. Shafer-Hine-Levy—Shafer's textbook of oral pathology, 5th ed. 2006.
2. Killey HC, Seword GR, Kay LN— An outline of oral surgery, part I.
3. Topozian RG, Goldberg MG—oral and maxillofacial infection, 3rd ed 1999.
4. Peterson, Ellis Hupp, Tucker—Contemporary oral and Maxillofacial Surgery, 4th ed, 2006.
5. Danier M Laskin—Oral and Maxillofacial surgery. The biomedical and clinical basis for surgical practice. Vol. 2.
6. Archer WH—Oral and maxillofacial surgery, 5th ed. vol. 1.

Inflammatory Disease of Jaw Bone

10

OSTEOMYELITIS OF JAW

Definition

It is a diffuse inflammation of the soft tissue and bone involving the cancellous bone marrow and the periosteal component. Osteomyelitis can also be defined as an inflammation of the medullary portion of the bone.

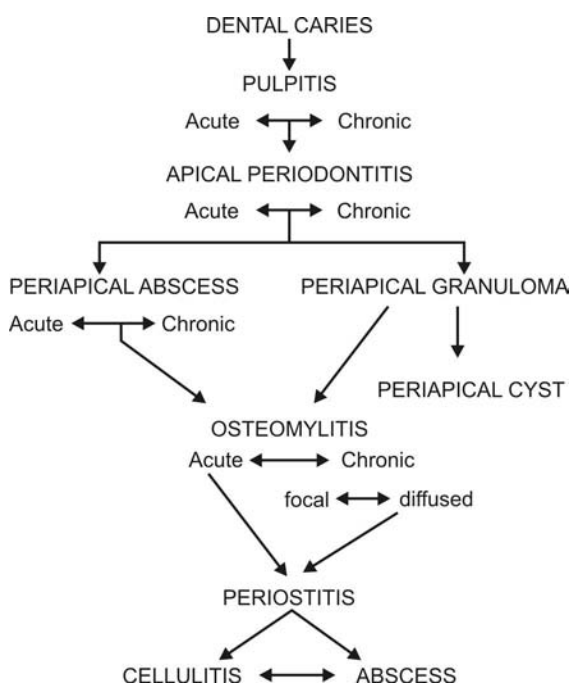
Osteomyelitis can be explained as an inflammatory condition of bone that begins as an infection of the medullary cavity and haversian systems and extends to involve the periosteum of the affected area.

Classification

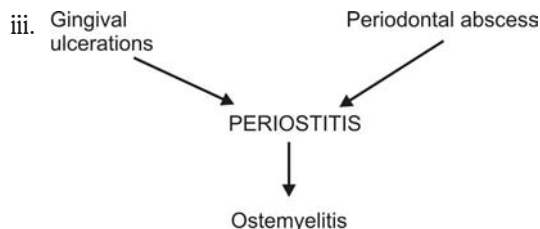
<i>Suppurative Osteomyelitis</i>	<i>Non-suppurative Osteomyelitis</i>
i. Acute suppurative osteomyelitis	i. Chronic sclerosing osteomyelitis
ii. Chronic suppurative osteomyelitis	ii. Focal sclerosing osteomyelitis
• Primary	iii. Diffuse sclerosing osteomyelitis
• Secondary	iv. Garre's sclerosing osteomyelitis
iii. Infantile osteomyelitis	v. Actinomycotic osteomyelitis
	vi. Radiation osteomyelitis and necrosis

Etiology

- Contigenous spread of odontogenic infection



- Trauma and injury leading to compound fracture of teeth.



- iv. Laceration and infections of the lymph node leading to osteomyelitis via hematogenous spread.

Osteomyelitis is more commonly seen in patients with reduced host resistance, altered jaw vascularity or those suffering from systemic diseases.

Pathogenesis

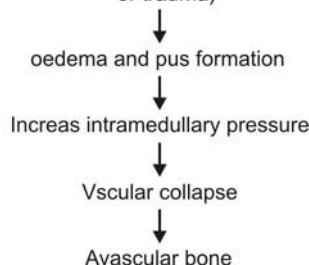
Osteomyelitis is initiated from a contiguous focus of infection or by hematogenous spread. Any condition leading to the avascularity of the medullary portion of the bone can lead to the occurrence of osteomyelitis in that particular bone.

Among the jaws, osteomyelitis is mostly seen in the mandible as--

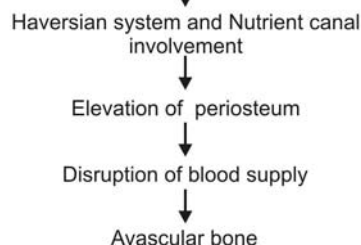
- Maxilla is more porous and richly supplied by blood vessels.
- Maxilla has thin cortical plates and paucity of medullary tissues due to which any maxillary infection remains confined within the bone and the edema and pus dissipates into the soft tissues and sinuses.

There are two sequelae which have been proposed for describing the pathogenesis of osteomyelitis.

1. Acute inflammation (because of odontogenic infection or trauma)



2. Multiplication of the pus forming micro organisms



The microorganisms causing osteomyelitis are mainly of staphylococcus species, and α -hemolytic streptococcus species. Besides these peptostreptococci, fusobacterium and prevotella species are also involved, thus mixed bacterial cultures are seen.

Clinical Features

Clinically osteomyelitis is of four types:

- i. Acute suppurative osteomyelitis
- ii. Secondary chronic osteomyelitis - Begins as acute and progresses to chronic
- iii. Primary chronic osteomyelitis - Has no acute phase and shows low grade infection
- iv. Non-suppurative osteomyelitis.

- i. *Acute suppurative osteomyelitis* is characterized by:

- a. Deep intense pain
- b. High intermittent fever
- c. Parathesia or anesthesia of lower lip
- d. A clear identifiable cause, usually deep caries in the involved tooth.
- e. Increased temperature and malaise.
- f. No radiographical findings
- g. Edema and tenderness of overlying tissue.

If disease is not controlled by empirical antibiotics within 10-14 days, it leads to established suppurative osteomyelitis and following findings are seen.

1. deep pain, malaise, fever ($101-102^{\circ}\text{F}$), anorexia.

2. Teeth begin to loosen and become sensitive to percussion
3. Pus exudates around gingival sulcus and through mucosa or cutaneous fistula.
4. Fetid oral odour
5. Firm cellulitis of cheek, abscess formation with localized warmth, erythema, tenderness on palpation and mental nerve parasthesia; expansion of the bone due to increased periosteal activity.
6. Regional lymphadenopathy.
 - ii. Secondary chronic osteomyelitis is characterized by:
 - a. Minimal pain
 - b. Presence of fistula.
 - c. Induration of soft tissue
 - d. A thickened or 'wooden' character to the affected area with pain and tenderness on palpation.
 - iii. Primary chronic osteomyelitis is characterized by:
 - a. Insidious onset with slight pain.
 - b. Slow increase in jaw size
 - c. Gradual development of sequestra, often without fistula.

Investigations

In acute stage osteomyelitis cannot be diagnosed using radiograph as there is less of mineralized bone destruction occurred.

In chronic stage, the following characteristic features are seen in a radiograph:

- a. Moth-eaten appearance of the bone involved because of enlargement of medullary and widening of Volkmann canal, secondary to destruction by lysis of bone and its replacement with granulation tissues.
- b. Sequestra formation due to bone destruction and islands of involucrum or new bone seen.
- c. Granular dense bone formed due to subperiosteal deposition of new bone and this central sequestra formed helps to distinguish osteomyelitis from fibrous dysplasia.

Scintigraphy or bone imaging or radionuclide scanning is a new diagnostic tool used to determine the presence of reactive bone. ^{99m}Tc -labelled phosphate compounds are given I.V to distribute to the entire skeleton and concentrate in areas of increased blood supply and reactive bone. Rectilinear scanner or scintillation camera is used to image technetium. The image obtained is used to reveal the distribution of radionuclide in areas of increased bone activity. This technique distinguishes reactive bone from the normal bone but is unable to distinguish between the reactive bone associated with osteomyelitis and other conditions like fibrous dysplasia. However, scintigraphy can confirm a diagnosis of very early osteomyelitis before any radiographic bone changes have occurred.

Treatment

Principles of Treatment of Osteomyelitis

1. Evaluation and correction of host defense deficiencies
2. Gram staining, culture and sensitivity
3. Imaging to rule out bone tumor.
4. Administration of stained - guided empirical antibiotics.
5. Removal of loose teeth and sequestra to decrease the number of bacteria.
6. Administration of culture guided antibiotics; repeated cultures.
7. Possible placement of irrigation drains/ polymethyl methacrylate - antibiotic beads.
8. Sequestrectomy, debridement, decortication, resection, reconstruction (surgical management)

Antibiotic Therapy for Osteomyelitis

Appropriate use of antibiotics depends on the stage of disease, host defense and ability to obtain materials for lab diagnosis.

Antibiotics of importance in the treatment of osteomyelitis are Penicillin, Penicillinase resistant

Penicillin, combination of both penicillin, clindamycin, cephalosporin and erythromycin.

Recommended antibiotics for osteomyelitis treatment are:

Early Empirical therapy Aqueous penicillin, 2 million units, I.V 4th hourly until symptoms have subsided for 48-72 hours, switch to penicillin V, 500 mg P.O, 4th hourly for 2-4 week.

Initial therapy after staining If smear suggests of staphylococcus infection - Oxacillin 1 gm, I.V 4th hourly until symptoms have subsided for 48-72 hours, then switch to Dicloxacillin 500 mg, P.O, 6th hourly for 2-4 weeks.

If smear suggests of anaerobic infection- Aqueous penicillin 2 million units I.V 4th hourly until symptoms have subsided for 48-72 hours then switch to penicillin V, 500 mg, P.O 4th hourly for 2-4 weeks.

For penicillin allergic patients Clindamycin, 600 mg, I.V 6th hourly then switch to clindamycin, 300-450 mg, P.O, 6th hourly OR Cefazolin 500 mg I.V or I.M 8th hourly then switch to cephalexin 500 mg P.O 6th hourly.

Surgical Management of Osteomyelitis

Initially in acute stage only removal of very loose teeth and bony fragments as well as incision and drainage of fluctuant area is indicated.

In chronic stage further surgical intervention is indicated, like

- i. Sequestrectomy with or without saucerization.
- ii. Decortication
- iii. Resection followed by reconstruction. Along with this Hyperbaric oxygen therapy (HBO) is used as an adjuvant to hasten healing.

Incision and Drainage

Intraoral or extraoral incision is carried out to relieve the patient of the pain and pressure caused by the accumulation of pus and also

prevent the further spread of infection. Pus drainage from the bone can be accomplished by:

- a. Opening up the pulp chamber
- b. Making fenestration through cortical plate over apical area.
- c. Making an incision and opening a window over the alveolar crest, especially in case of edentulous posterior maxilla.
- d. Making a small incision over the point of greatest tenderness or below mandible in case of osteomyelitis of ramus or angle of mandible.

Sequestrectomy With or Without Saucerization

Sequestrectomy is the removal of the sequestra to prevent the spread of infection and minimize tooth mobility (Fig. 10.1).

Sequestra are cortical or cortico - cancellous bone generally formed 2 weeks after the onset of infection and are avascular bony fragments which are poorly penetrable by antibiotics and are highly susceptible to pathologic fracture. To prevent high instances of fracture, spread of infection and hasten healing, sequestrum is surgically removed.

Saucerization is the excision of the margins of necrotic bone overlying an osteomyelitis which will allow visualization of sequestra before removal (Fig. 10.2). This procedure is performed immediately after the acute stage and is rarely done in maxilla as oro-antral fistula can result.

Procedure

- Reflection of the buccal flap of the affected region to expose bone.
- Remove the loose teeth.
- Buccal plate is reduced by rongeurs to produce saucer like defect.
- Granulation tissue and debris are removed and the area is thoroughly irrigated.

- The buccal flap is trimmed and medical pack (iodoform gauze and antibiotic pack) is put to promote healing.
- Pack is maintained by sutures until bone margin is healed.

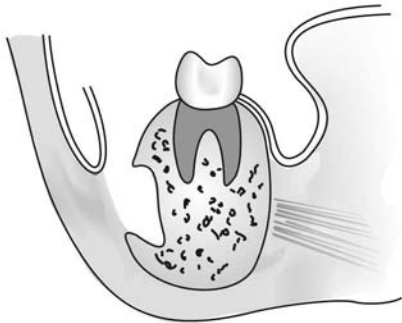


Fig. 10.1: Sequestrectomy

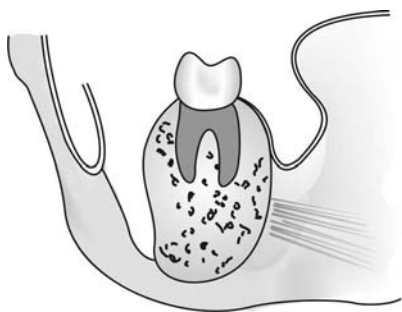


Fig. 10.2: Saucerization

Decortication

Decortication is the removal of chronically infected cortex of bone. It is done during the subacute or chronic stage of infection thus removing the avascular infected cortical bone.

Decortication is done in conditions where the initial conservative treatment has failed and also as an initial treatment of primary and secondary chronic osteomyelitis.

Procedure

- Reflection of the mucoperiosteum.
- Removal of the involved tooth.
- Removal of lateral cortical plate and the inferior border, 1-2 cm beyond the affected area to provide access to the medullary cavity (Fig. 10.3).
- Thorough debridement of the tissues and flap closure.
- Irrigation tube may be placed through separate cutaneous stab incisions and closed irrigation suction may be employed.

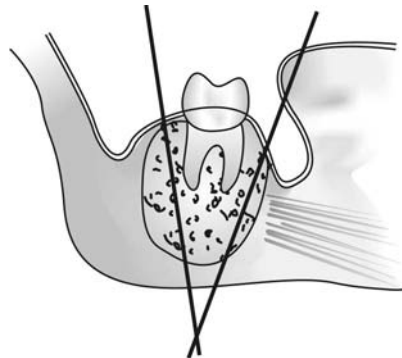


Fig. 10.3: Decortication

Resection Followed By Reconstruction

This is an aggressive procedure indicated during the following conditions:

- Pathological fracture
- Persistent infection after decortication
- Marked disease of both cortical plates.

Osteotomy is performed by an intraoral route and immediate reconstruction is done using a block of cancellous iliac crest bone or cancellous marrow which is stabilized with titanium mesh, thus helping in rehabilitation of the region.

Complications During Surgical Management

- Bleeding
- Injury to inferior alveolar nerve
- Pathological fracture
- Discontinuity defect

TYPES OF OSTEOMYELITIS

Garre's Osteomyelitis

(Chronic osteomyelitis with proliferative periostitis, chronic non-suppurative sclerosing osteomyelitis, periosteitis ossificans)

It is a focal gross thickening of the periosteum with periapical reactive bone formation caused due to mild irritation or infection.

Features

- Mainly seen in children and young adults.
- Mostly associated with carious mandibular 1st molar but occasionally there may be no dental etiology.
- Clinically, a localized, hard, non tender, bony swelling of the lateral and inferior aspect of the mandible is seen.
- Radiographically a characteristic 'ONION SKIN' appearance is seen formed by the laminated, smooth, focal, calcified bone proliferation.
- *Staphylococcus aureus* and *Staphylococcus epidermidis* are the chief micro-organisms associated.
- Treatment is best achieved by removing the potential source of inflammation by endodontic therapy or extraction of the tooth involved. Antibiotics may not be administered unless infection is present and post treatment follow-up is essential.

Condensing Osteitis (Chronic focal sclerosing osteomyelitis)

It is an unusual reaction of bone to infection occurring in instances of extremely high tissue resistance or in cases of low grade infections

Features

- Usually seen in patients below 20 years of age.

- Mostly associated with infected pulp of mandibular molars or premolars.
- Clinically the lesion is generally asymptomatic with no or mild signs of pain.
- Radiographically, a circumscribed radiopaque mass of sclerotic bone with distinct or indistinct margins is seen associated with the affected tooth roots.
- Histologically, a dense mass of bony trabeculae with little interstitial marrow, soft tissues and lymphocytes is seen.
- Treatment is best achieved by endodontic therapy or extraction of the infected tooth.
- A similar condition is seen which is diffused or multiple in form and is known as chronic diffused sclerosing osteomyelitis. This condition is treated by surgical sequestrectomy and debridement, decortication or resection with reconstruction and adjuvant antibiotic therapy.

Infantile Osteomyelitis

This is an uncommon condition associated with infants but deserves a special care due to the potential facial deformities resulting from delayed or inappropriate treatment.

Features

- Infantile osteomyelitis is caused due to hematogenous spread of infection from mother, perinatal trauma of oral mucosa, infections of maxillary sinus or contaminated human or artificial nipples.
- Mostly seen in infants a few weeks after birth and mainly maxilla is affected.
- Clinically, a facial cellulitis is present about the orbit. Patient also shows fever, malaise, irritability, dehydration, anorexia, convulsion, palpebral edema, conjunctivitis, sinusitis and vomiting.
- Treatment should be prompt and aggressive to prevent optic damage, neurologic

complications, and loss of tooth buds and bone. Antibiotic therapy with incision and drainage generally suffice as the management. Occasionally sequestrectomy may be necessary.

Actinomycotic Osteomyelitis

It is a chronic infection manifesting both granulomatous and suppurative features that usually involve soft tissue and occasionally bone of the cervicofacial, abdominal and thoracic region.

Features

Clinically actinomycosis is of four types:

- Cervicofacial (most common)
- Abdominal
- Thoracic
- Cutaneous.
 - Actinomycosis is caused due to an infection of a gram positive filamentous bacteria- Actinomycosis Israelii, Actinomycosis viscosus, Actinomycosis odontolyticus in patients with trauma, dental caries or other hypersensitive reactions.
 - Clinically, a firm, soft tissue mass which is oily, purplish or dark red is seen on the skin. Small fluctuant areas which may show spontaneous drainage of serous fluid containing granular material may occur.
 - Regional lymphadenopathy is common.
 - Radiographically, a radiolucency is seen associated with delayed healing of extracted site.
 - Histologically the yellow granules shows closely packed branching filamentous colonies.
 - Treatment is best achieved by a combination of antibiotic therapy and surgery involving incision and drainage of the

purulent material with debridement of surrounding tissues. Currently iodides and radiotherapy are also used effectively.

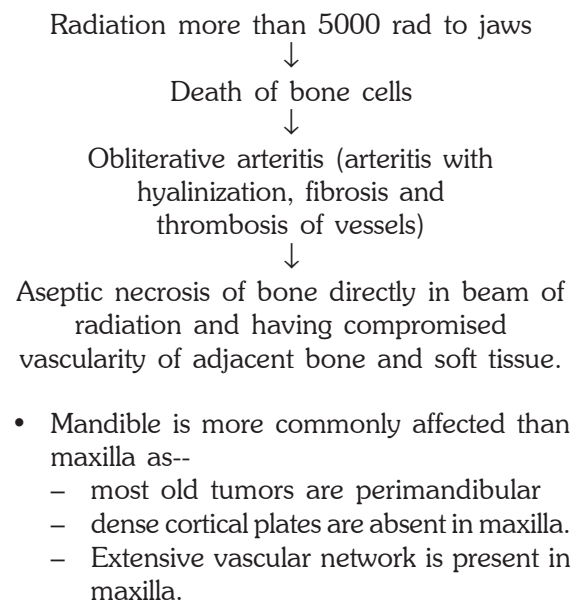
OSTEORADIONECROSIS

Definition

It is a chronic, nonhealing wound caused by hypoxia, hypocellularity and hypovascularity of irradiated tissues.

Pathogenesis

It is a radiation induced, nonhealing and hypoxic wound rather than true osteomyelitis of irradiated bone.



Clinical Features

- Severe deep pain continuing till weeks or months
- Presence of soft tissues abscess or draining sinus and fistula
- Exposed bone with abraded and ulcerated soft tissue (Fig. 10.4)

- Facial swelling is present when infection develops
 - Trismus
 - Fetid odour
 - Pyrexia
 - Pathological fracture.
 - Radiographically, there is hardly any changes seen as sequestra and involucra formation is not seen or seen late in an irradiated bone because of severely compromised blood supply.
5. Maintaining post-irradiation dental health
 - a. extraction is contraindicated for 6-9 months
 - b. Dentures should not be worn for 1 year
 - c. Salivary substitutes are advised because of xerostomia.
 - d. Endodontic treatment is indicated for post irradiated pulpitis and not extraction. If extraction is at all necessary then should be done under proper care and for 1-2 teeth only.

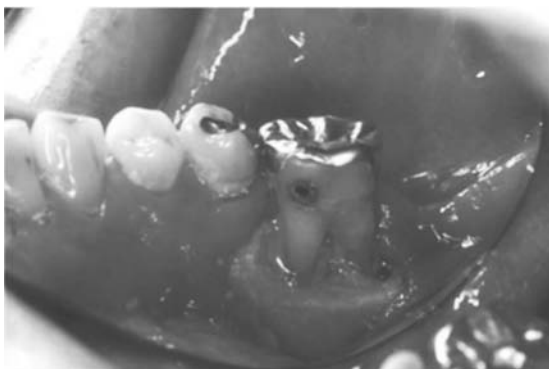


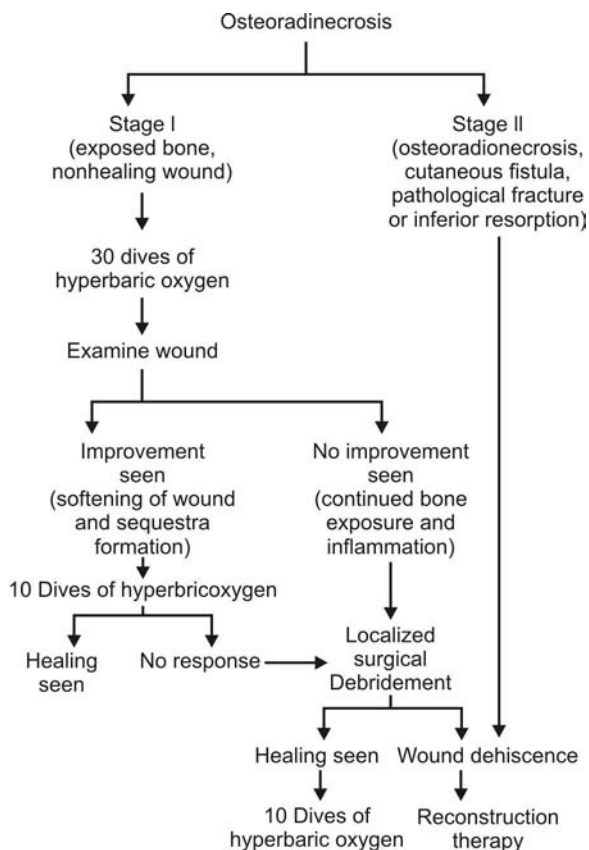
Fig. 10.4: Clinical view of osteoradionecrosis involving the mandible (For color version see plate 3)

Management

Prevention of Osteoradionecrosis

1. Use of megavoltage commonly obtained from cobalt teletherapy units, instead of the use of orthovoltage in radiotherapy units.
2. Dose fractionation
3. Collimation to shield normal tissues
4. Maintaining pre-irradiation dental health
 - a. extraction of teeth 2-3 weeks before radiation therapy done with alveoloplasty.
 - b. Restoration of dental caries and periodontal health
 - c. Fluoride application
5. Maintaining post-irradiation dental health
 - i. Administration of antibiotics (penicillin and metrinidazole), analgesics and supportive therapy with fluid, high protein and vitamin diet.
 - ii. Irrigation of exposed bone and soft tissue margin.
 - iii. Mechanical debridement and smoothening of bone using bone files and burs, and medicated dressing with zinc peroxide and neomycin. (irrigation and medicated dressing is repeated weekly until sequestra has occurred or bone is penetrated by granulation tissues).
 - iv. Series of holes are drilled perpendicular to lingual cortical plate to the depth at which bleeding bone is encountered. This method was used earlier to encourage revascularization of the bone (ultrasound therapy)
 - v. Hyperbaric oxygen therapy with or without bone resection.

Generally patients are treated for osteomyelitis as outpatients but hospitalization may be required for patients who shows toxic symptoms and are dehydrated to permit supervised administration of antibiotics and fluids.



- Proliferation of granulation tissues
- Enhances arterial and venous oxygen tension.
- Enhances sequestra formation and replacement of devitalised bone.

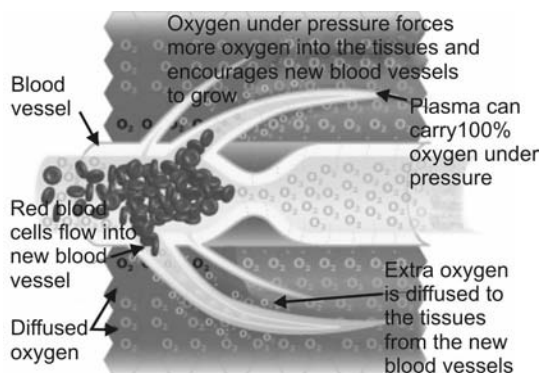


Fig. 10.5: Mechanism of HBO therapy
(For color version see plate 3)

Indications

- Osteoradinecrosis
- Refractory chronic suppurative osteomyelitis
- Refractory chronic sclerosing osteomyelitis
- Diffused sclerosing osteomyelitis

Contraindications

- Optic neuritis
- Immunosuppressive diseases.

HYPERBARIC OXYGEN THERAPY (A PROCEDURE USED AS AN ADJUVANT TO SURGERY)

It is a process of breathing 100 percent oxygen at 2.4 atmospheric pressure for 90 mins/dive, 5 days/week. Totalling 30 sessions (Marx protocol)

Mechanisms

- Bacteriostatic affect on microbes
- Induces neo-angiogenesis
- Fibroblast proliferation under increased oxygen tension



Fig. 10.6: Hyperbaric oxygen therapy unit
(For color version see plate 3)



Fig. 10.7: Patient under treatment in small unit
(For color version see plate 3)

Advantages

- Decreases pain
 - Decreases trismus and increases patient comfort.
- Helps in fistula closure.
 - Clinical and radiological healing
 - Enhances bone graft osteogenesis.

FURTHER READING

1. Archer WH — Oral and maxillofacial surgery, 5th ed, vol. 1.
2. Gustav O Kruger — Textbook of oral and maxillofacial surgery, 16th ed.
3. Peterson, Ellis, Hupp, Tucker — Contemporary oral and maxillofacial surgery, 4th ed, 2006.
4. Shafer-Hine-Levy — Shafer's textbook of oral pathology, 5th ed, 2006.
5. Topazian RG, Goldberg MG — Oral and maxillofacial infection, 3rd ed, 1994.
6. White and pharaoh — Oral radiology, principles and interpretation, 5th ed, 2006.

Surgical Procedures in Prosthodontics– Preprosthetic Surgery

11

Preprosthetic surgery are the surgical procedures carried out to reform or redesign denture bearing areas to create an oral environment to support a functional prosthetic appliance.

Aims of Preprosthetic Surgery

1. Provide adequate bony tissues for prosthesis support (Ridge height and width)
2. Provide adequate soft tissue support
3. Eliminate pre-prosthetic bony deformities (Tori, Exostosis)
4. Correction of maxillary and mandibular ridge relation
5. Relocate abnormal frenum and muscle attachment
6. Relocate mental nerve
7. Establishing correct vestibular depth.

Classification of Preprosthetic Surgery

I. Ridge Correction Procedures

1. Hard tissue correction:
 - i. Alveoloplasty
 - a. simple alveoloplasty
 - b. single tooth alveoloplasty
 - c. radical alveoloplasty
 - d. interdicular alveoloplasty or interseptal alveoloplasty
 - ii. Excision of tori
 - a. maxillary tori excision
 - b. mandibular tori excision.

- iii. Reduction of maxillary tuberosity
 - iv. Reduction of genial tubercle.
 - v. Reduction of mylohyoid ridge.
2. Soft tissue correction:-
 - i. Frenectomy
 - a. Labial frenectomy
 - b. lingual frenectomy
 - c. Buccal frenectomy
 - ii. Removal of crestal soft tissue
 - iii. Removal of epulis fissuretum or fibrous hyperplasia or denture fibrosis.

II. Ridge Extension Procedures: (Vestibuloplasty or sulcoplasty or sulcus deepening procedures)

1. Maxillary procedures:
 - i. Secondary epithelization technique
 - ii. Sub mucosal technique
 - iii. Grafting technique
2. Mandible procedures:
 - i. Buccal or labial approach
 - ii. Lingual approach
 - iii. Labial and lingual approach (floor of the mouth lowering procedure)

III. Ridge Reconstruction or Augmentation Procedures

1. Ridge reconstruction with non-resorbable hydroxyapatite (onlay grafts)

2. Ridge augmentation with iliac crest bone or rib bone graft.
3. Ridge augmentation using osteotomy technique:-
 - i. Interpositional bone graft
 - ii. Sinus lift procedure
 - iii. Augmentation with orthognathic surgery
 - iv. Visor osteotomy procedure
 - v. Sandwich osteotomy procedure
4. Implants for ridge reconstruction
 - i. Endosteal implants
 - ii. Subperiosteal implants
 - iii. Transosteal implants

CHARACTERISTIC OF AN IDEAL RIDGE FOR BEST DENTURE SUPPORT

They are:

1. No evidence of intraoral or extraoral pathologic conditions.
2. Proper interarch jaw relationship in the anteroposterior, transverse and vertical dimensions.
3. Alveolar process that are as large as possible and of the proper configuration. (The ideal shape of the alveolar process is a broad U-shaped ridge with the vertical components as parallel as possible)
4. No bony or soft tissue protuberances or undercuts.
5. Adequate palatal vault form.
6. Proper posterior tuberosity notching
7. Adequate attached keratinized mucosa in the primary denture bearing area.
8. Adequate vestibular depth for prosthesis extension
9. Added strength where mandibular fracture may occur.
10. Protection of the neurovascular bundle.
11. Adequate bony support and attached soft tissue covering to facilitate implant placement when necessary.

I. RIDGE CORRECTION PROCEDURES

1. Hard Tissue Procedures

- i. *Alveoplasty or Alveolectomy*: It is a process of surgically removal of a portion of the alveolar bone or shaping of alveolar ridge. This procedure is mostly done after multiple extraction or on uneven ridges with a goal of conservation of maximum amount of bone consistent with a good ridge. The most conservative procedures is, compression of the alveolar wall by finger and thumb pressure.
- ii. *Excision of tori*: A tori is a benign outgrowth present only the mid-palatal suture of maxilla (maxillary tori) or along the lingual surface of mandible (mandibular tori). These are removed to increase denture retention and stability. Proper clinical and Radiographic evaluation should be done prior to surgery to rule out pneumatization of tori (to prevent formation of oro-antral fistula) in case of maxilla and nearness to mandibular canal (to prevent damage to nerve bundles) in case of mandible.
- iii. *Reduction of maxillary tuberosity*: Maxillary tuberosity is the bulbous extension of the residual ridge in the upper second and upper third molar region. In certain cases this tuberosity is excessively enlarged (either fibrous enlargement or bony enlargement) and is better to be reduced to increase intermaxillary space in the posterior region and make the ridge regular. Proper preoperative investigations should be done to differentiate between fibrous or bony enlargement and to rule out nearness to maxillary sinus, thus prevent formation of oro-antral fistula.
- iv. *Maxillary Tuberosity*: This is a procedure done to increase the depth of the hamular notch and the distal aspect of maxilla in case of flat maxillary ridge, thus preventing anterior displacement of the denture.

Types of Alveoplasty and Their Procedures

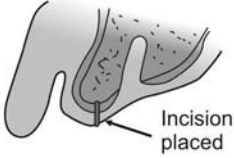
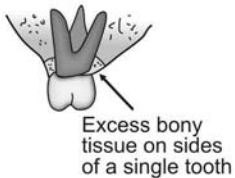
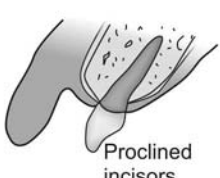
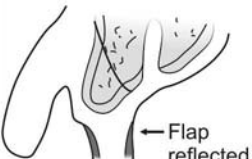
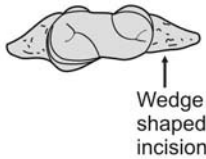
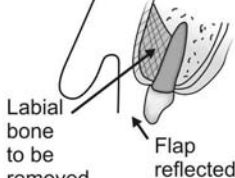
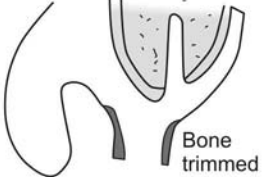
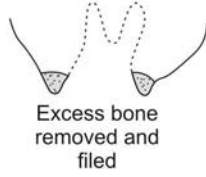
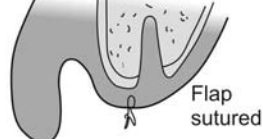
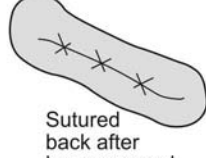
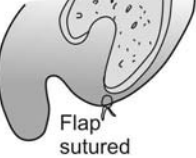
a. Simple - here, buccal alveolar plates and interseptal bone is removed.	b. Single tooth - done following removal of isolated posterior tooth to Reduce the prominent buccal cortical undercut.	c. Radical - here complete labial plate is removed in cases of extreme prominent undercut, skeletal horizontal jaw discrepancy or in preradiation therapy	d. Interradicular or Interseptal - here the interradicular bone is removed in cases of prominent premaxilla or skeletal class II disproportion
 Incision placed Step 1	 Excess bony tissue on sides of a single tooth Condition	 Incision placed Step 1	 Proclined incisors Condition
 Flap reflected Step 2	 Wedge shaped incision Step 1	 Labial bone to be removed Flap reflected Step 2	 Inter-radicular bone and tooth removed Step 1
 Bone trimmed Step 3	 Excess bone removed and filed Step 2	 Labial bone and tooth removed Step 3	 Dean's method only labial bone moved and flap sutured Step 2
 Flap sutured Step 4	 Sutured back after bone removal Step 3	 Flap sutured Step 4	 Obwegeser method both palatal and labial bone moved Step 2

Fig. 11.1

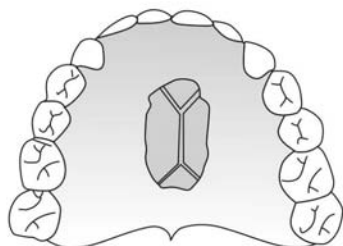
Fig. 11.2

Fig. 11.3

Fig. 11.4

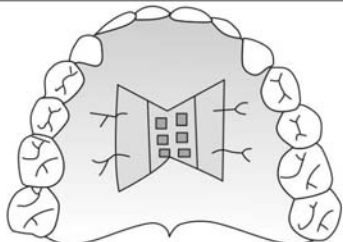
Maxillary Torus Removal

Maxillary torus removal



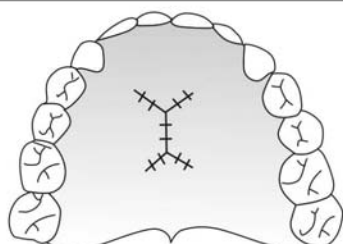
Double Y incision placed

Step 1



Flap reflected and torus divided into 6 segments

Step 2



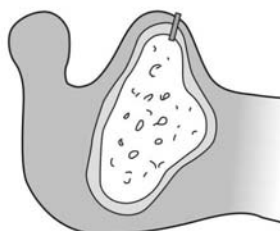
Flap sutured and stent placed

Step 3

Fig. 11.5

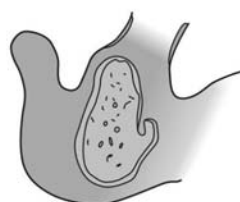
Mandibular Torus Removal

Mandibular torus removal



Incision placed along crest

Step 1



Flap reflected and grooving of tori is done and then removed with chisel

Step 2



Suture placed and splint is placed

Step 3

Fig. 11.6

Maxillary Tuberosity Reduction

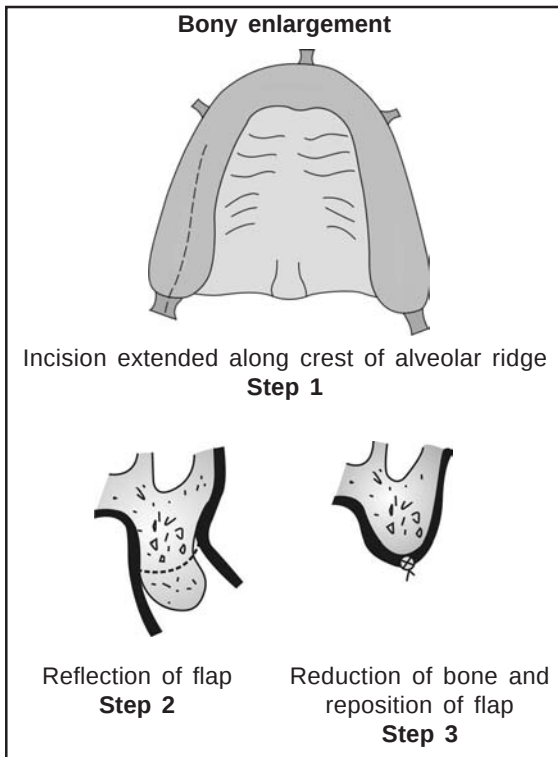


Fig. 11.7

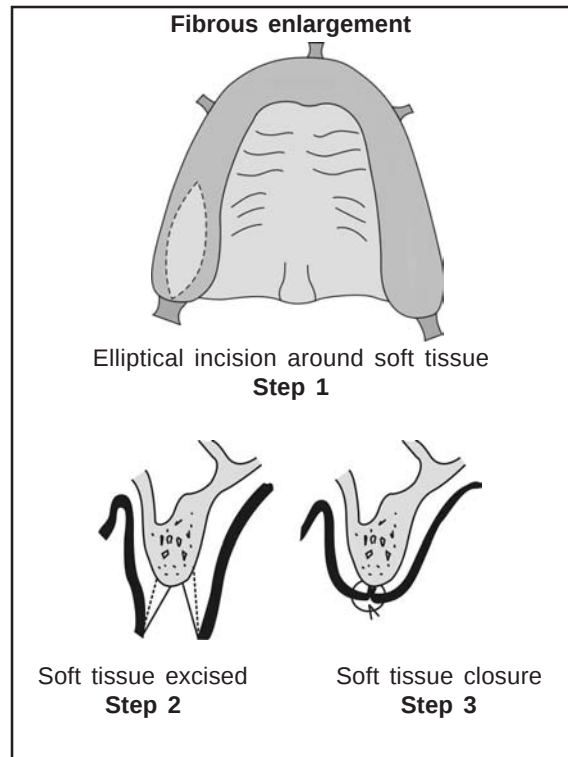


Fig. 11.8

Maxillary Tuberoplasty

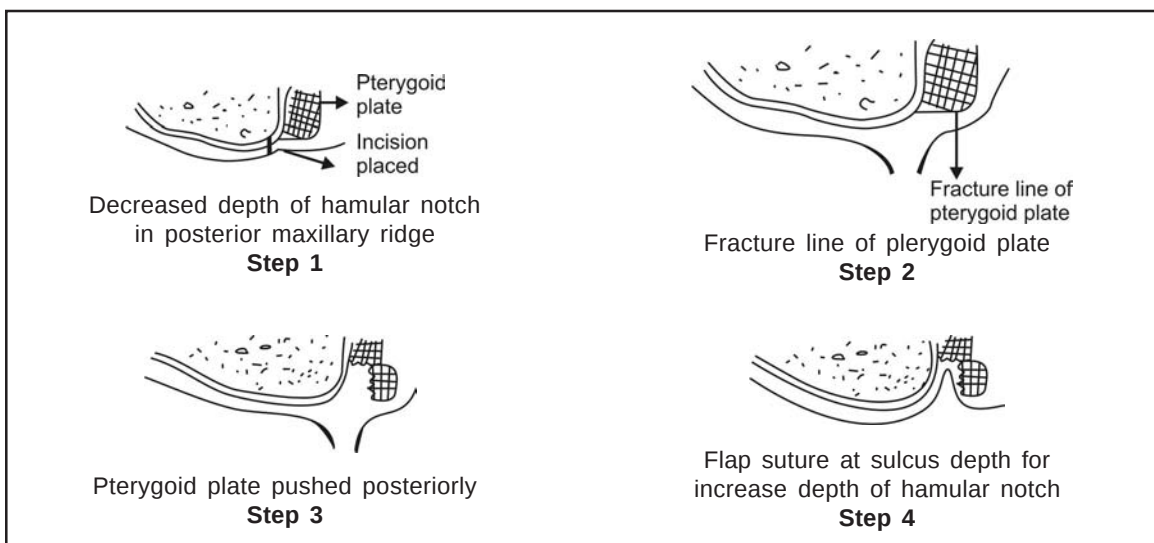


Fig. 11.9

2. Soft Tissue Correction

- i. **Frenectomy:** Frenum is a fibrous band of tissue present on the maxilla and the mandible which connects the lip or the tongue to the jaw. Frenectomy is the surgical removal of the excessively high frenum to increase denture stability.

This procedure also increases the mobility of the tongue (In case of high mandibular lingual frenum, ankylosis of tongue occurs) and improves the esthetics of the patient.

- a. Labial Frenectomy
- b. Lingual Frenectomy

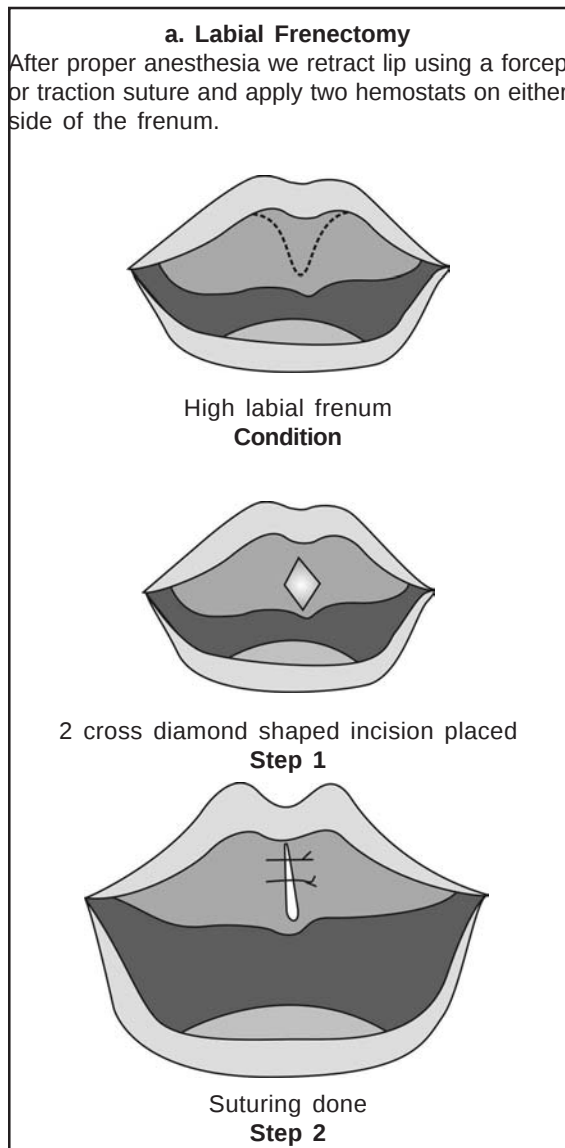


Fig. 11.10

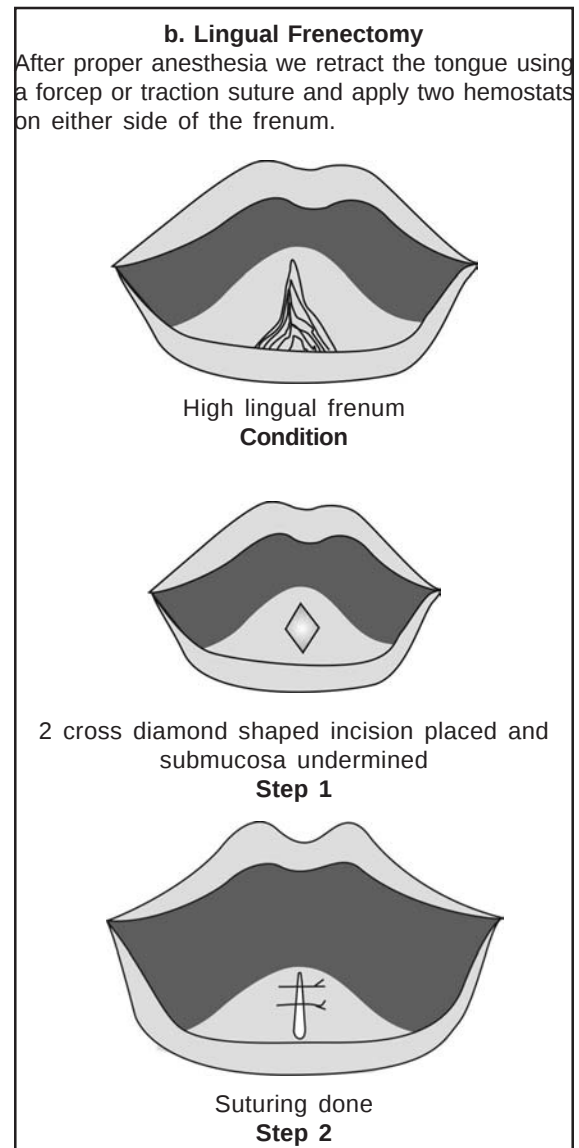


Fig. 11.11

Frenoplasty: This is the procedure of incising the frenum and suturing it back to a new position to alter its structure.

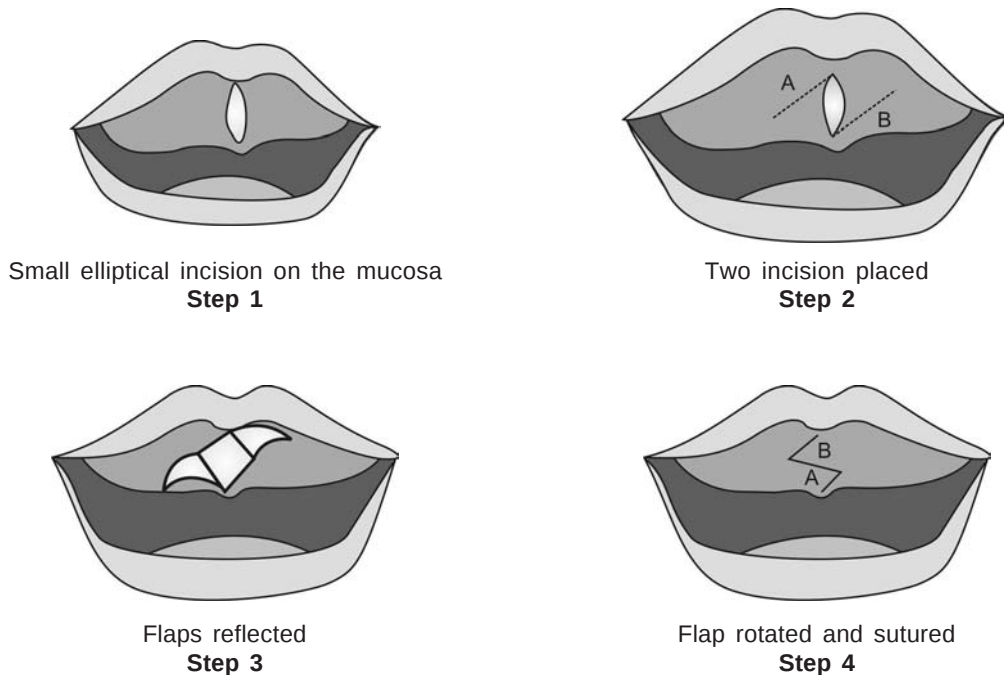


Fig. 11.12

iii. **Removal of epulis fissuratum or fibrous hyperplasia or denture fibrosis.**

Epulis fissuratum or fibrous hyperplasia or denture fibrosis is a generalized hyperplastic enlargement of mucosa and fibrous tissue in the

alveolar ridge and vestibular area mostly due to illfitting dentures. The conditions are mostly treated by conservatively by relieving the area and soft tissue liners. In certain severe cases surgical treatment is also done.

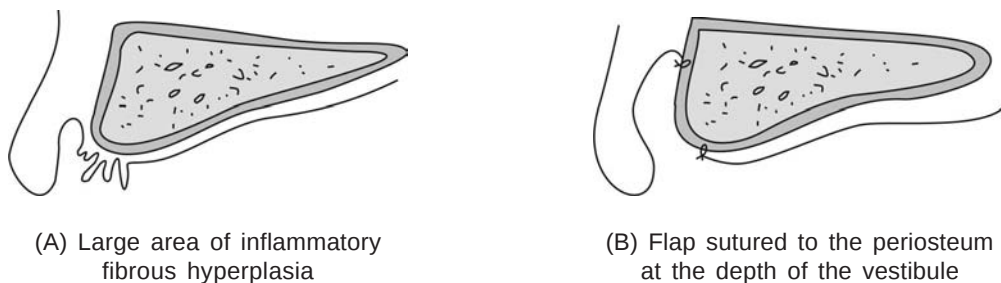


Fig. 11.13

II. RIDGE EXTENSION PROCEDURE (VESTIBULOPLASTY/SULCOPLASTY)

Vestibuloplasty is the uncovering of existing basal bone of jaw surgically by repositioning the overlying mucosa, muscle attachment and muscle to a lower position in mandible or to a superior position in maxilla.

1. Maxillary Procedures

- i. Submucosal technique (Obwegeser)
- ii. Grafting technique (combined pedicled mucosal transposition flap and skin graft).

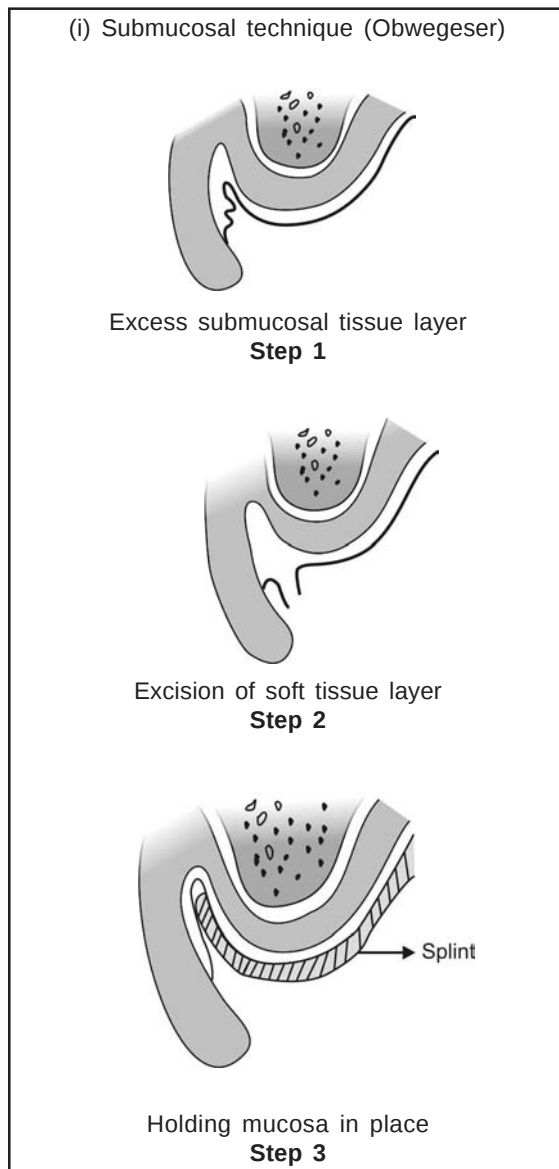


Fig. 11.14

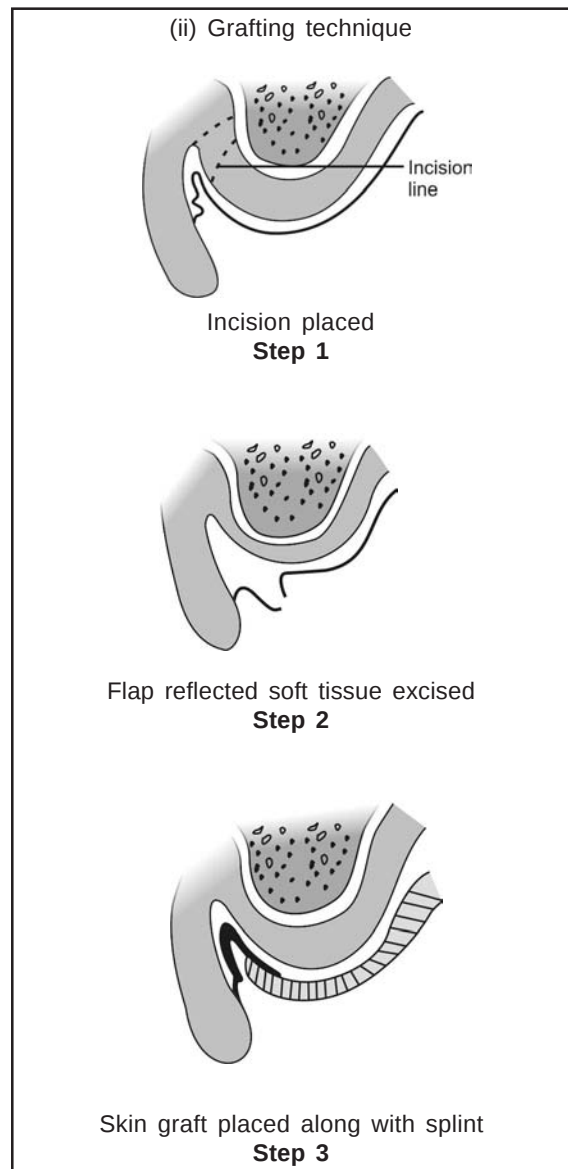


Fig. 11.15

2. Mandibular Procedures

- i. Buccal or labial approaches: This is the process of increasing the vestibular depth of the labial side. The various procedures for this are:

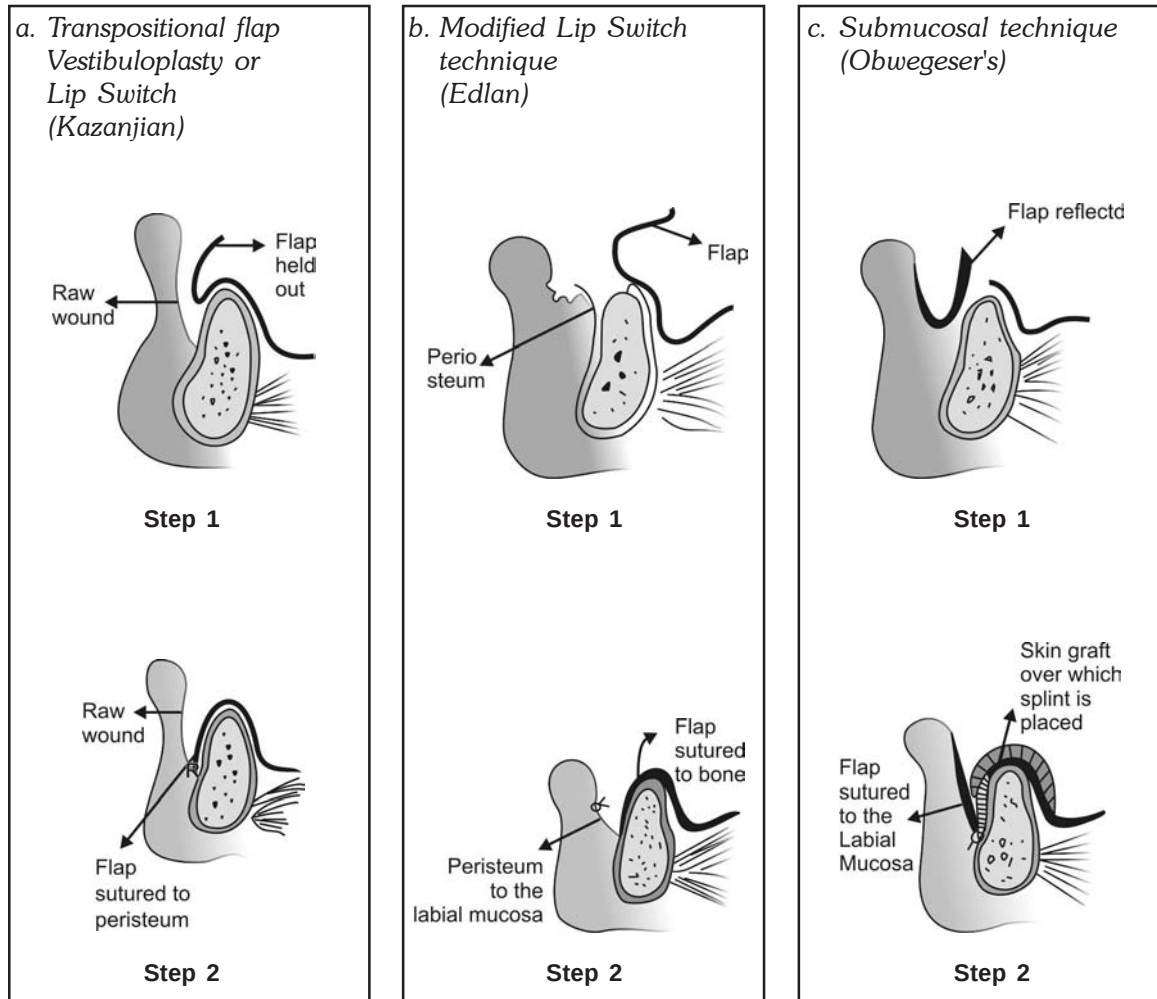


Fig. 11.16

The technique overcomes the drawback of the lip switch technique of scar formation and long term post-operative pain

Fig. 11.17

Fig. 11.18

ii. Lingual approaches:

a. *Lingual sulcus extension*
(Trauner)

- Here mylohyoid muscle is repositioned.

b. *Lingual ridge extension*
(Caldwell)

- Here full thickness mucoperiosteum is Dissected.

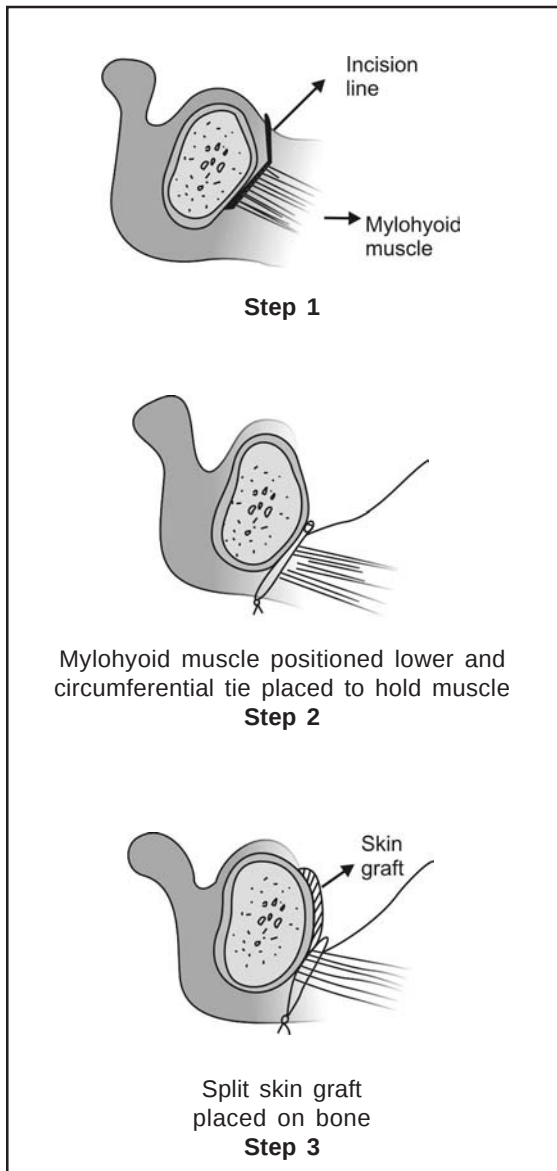


Fig. 11.19

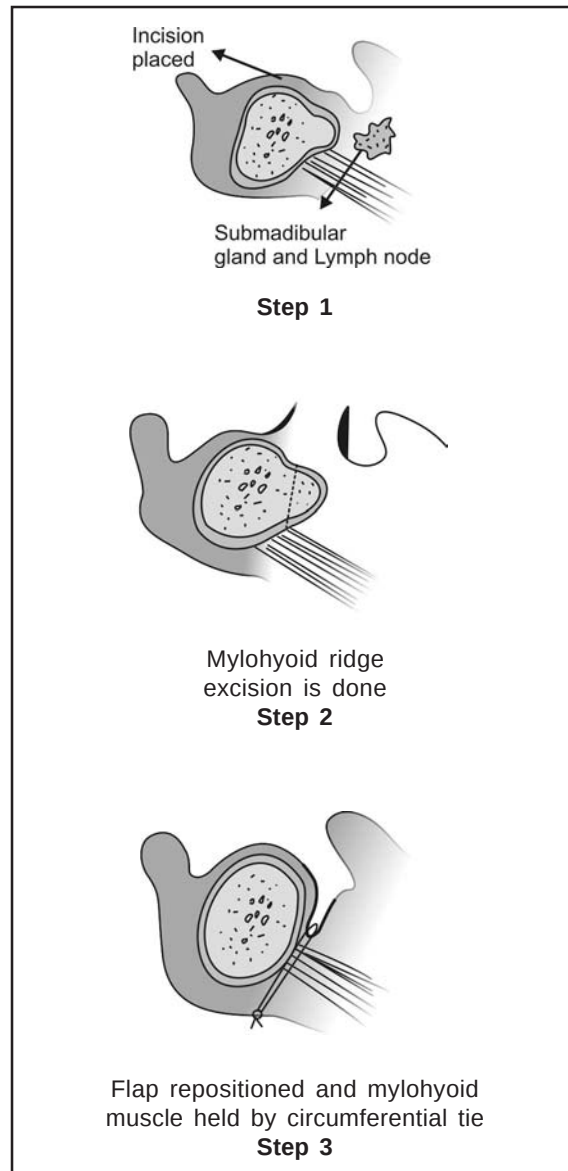


Fig. 11.20

- iii. Labial and lingual approach:
(Floor of mouth lowering procedure—Obwegeser)

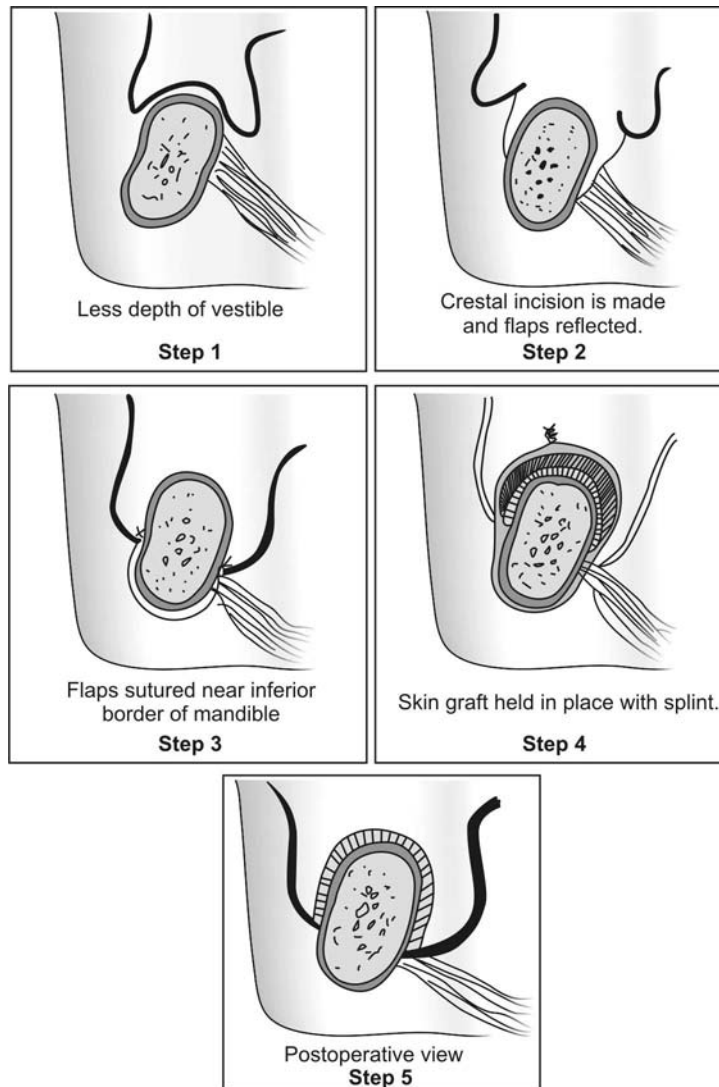


Fig. 11.21

III. RIDGE RECONSTRUCTION OR AUGMENTATION PROCEDURES

These are procedures to increase the alveolar ridge height in case where the ridge has fully resorbed and other methods like vestibuloplasty has failed.

Indications

1. Gross atrophy of alveolus and possibility of further resorption.
2. Localized severe alveolar ridge defects following surgery
3. Young patients with severe jaw atrophy
4. Atrophic maxilla causing prosthetic difficulty.

Graft Materials Used For Augmentation

1. Autografts/autogenous bone grafts:
 - i. Iliac crest bone (commonly used)
 - ii. Rib bone (Vth and VIIth rib)
2. Alloplastic bone graft material:
 - i. Hydroxyapatite (non- resorbable)
 - ii. Tricalcium phosphate (resorbable)
3. Allogenic bone graft
 - i. Freeze dried bone grafts
 - ii. Surface decalcified freeze dried bone grafts.
4. Xenograft materials
 - i. Bio-oss (bovine)

Procedures used for Reconstruction or Augmentation

1. Ridge reconstruction using non-resorbable hydroxyapatite materials (only grafts).

Techniques

After instituting proper local anesthesia a midline incision (for maxilla) or bilateral vertical mucoperiosteal incision (for mandible) is done on the ridge and a subperiosteal tunnel is made. Hydroxyapatite graft material is inserted and held in position by sutures followed by splint (Fig. 11.22).

Complications

1. Dehiscence with extrusion of hydroxyapatite particles.



Fig. 11.22: Injection of hydroxyapatite into subperiosteal tunnel

2. Migration of hydroxyapatite particles.
3. Abrasion of mucosa and extrusion of particles
4. Infection
5. Abnormal colour over ridge.
6. Mental neuropathy.

2. Ridge augmentation with iliac crest bone or rib bone graft

This technique is used to overcome the complication of bone resorption and graft extrusion of only bone graft procedure.

- i. Superior border augmentation technique

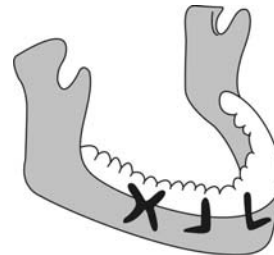


Fig. 11.23: Superior border grafting of atrophic mandible held by plates and screws

- ii. Inferior border augmentation technique

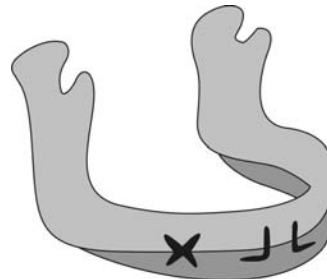


Fig. 11.24: Inferior border grafting done and held by plates and screws

3. Ridge augmentation using osteotomy technique

i. Interpositional bone graft

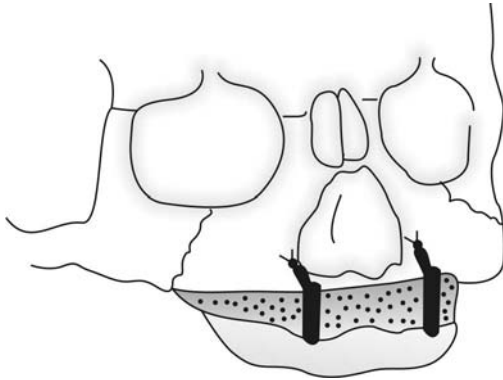


Fig. 11.25: Graft and maxilla is stabilized using rigid fixation plates

ii. Sinus lift procedure.

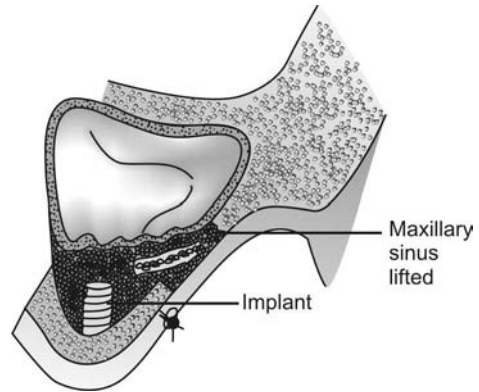


Fig. 11.26: Sinus lift

iii. Augmentation with orthognathic surgery:

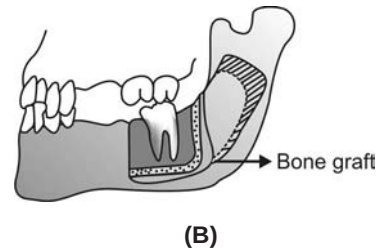
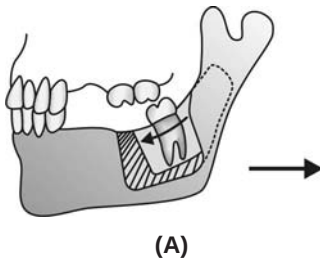


Fig. 11.27: Mandibular sequential osteotomy to reposition molar tooth to function

iv. Visor osteotomy procedure: Here the lingual bone is raised and adapted to the remaining mandible (Figs 11.28A and B).



(A) Vertical osteotomy procedure

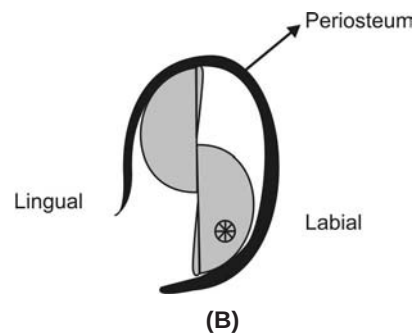


Fig. 11.28

- v. Sandwich osteotomy procedure: This is a combination of horizontal osteotomy in the anterior region and vertical osteotomy in the posterior region (Figs 11.29A to C).

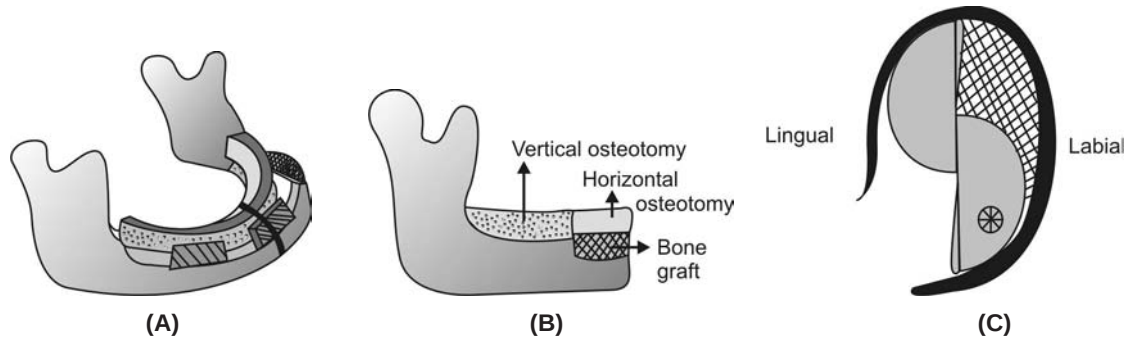


Fig. 11.29: Sandwich osteotomy procedure

4. Implants for ridge reconstruction

A dental implant is a biologic or alloplastic biomaterial, surgically inserted into the soft tissue or hard tissue of mouth for functional or cosmetic purposes.

Classification of Dental Implants

- I. Depending on usage:
 1. Endosteal implants
 - i. Root form implants
 - a. Cylinder type
 - b. screw type.
 - ii. Platform implants (blade)
 2. Subperiosteal implants
 3. Transperiosteal implants.

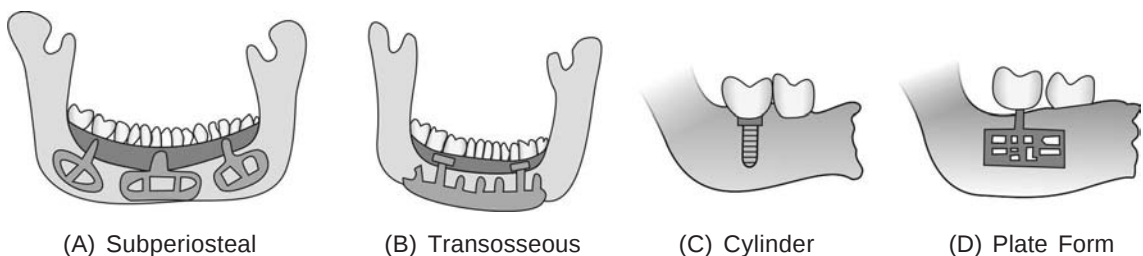


Fig. 11.30: Types of dental implants

II. Depending on the material used:

1. Metal and alloy
 - i. Titanium
 - ii. Stainless steel
 - iii. Chromium - cobalt - molybdenum alloy
 - iv. Gold plated
2. Ceramic/porcelain
 - i. Bioactive glass
 - ii. Hydroxyapatite (HA)
 - iii. Aluminum oxide
3. Composite/resin
 - i. Polymethylmethacrylate
 - ii. Polyethylene
 - iii. Polypropylene
 - iv. Silicon
4. Carbon implants

Indications of Implants

1. Edentulous patients
2. Ridge resorbed cases
3. Multiple missing teeth
4. Single missing tooth
5. Patient's desire
6. Severe parafunctional habits.
7. Poor oro-muscular coordination

Contraindications of Implants

1. Acute illness
2. Terminal illness
3. Pregnancy
4. Uncontrolled metabolic disease
5. Tumor/radiation to the implants site.
6. Unrealistic expectation
7. Improper motivation
8. Lack of operator experience.
9. Unable to restore prosthodontically.

Implants Success Criteria

1. The individual unattached implant is immobile when tested clinically.
2. No evidence of periimplant radiolucency is present, as assessed on an undistorted radiograph.

3. The mean vertical bone loss is less than 0.02 mm annually after the first year of service.
4. No persistent pain, discomfort, or injection is attributable to the implant.
5. The implant design does not preclude placement of a crown or prosthesis with an appearance, that is satisfactory to the patient and the dentist.

Biological Consideration in Implant - Tissue Interface

1. *Soft tissue - implant interface reactions:* The collagen fibres at the junctional epithelium-implant interface runs at right angle forming a tight cuff of fibrous connective tissue which supports the epithelium seal and forms an effective barrier to peri-implant pocket formation and bone loss.
2. *Bone - implant interface reactions:*
 - i. *Fibro-osseous integration:* It is the presence of healthy dense collagenous tissue between the bone and implant. In this conditions the fibres run irregularly parallel to the implant body and thus this interface shows a very low success rate.
 - ii. *Osteointegration:* It is a direct structural and functional contact between living bone and a load carrying implant. This condition is similar to ankylosis and provides a high success rate. The factors needed for this are:
 - biocompatible material choice
 - Implant precisely adapted to prepared bone site.
 - Atraumatic surgery to minimize soft tissue damage.
 - Immobile, undisturbed healing phase.

Techniques of Implant Surgery

1. Endosteal implant insertion

- i. *One- stage or single insertion procedure:* Here, implant is placed in the jaw with the prosthetic part of the implant extruding onto the oral cavity. The implant is stabilized in

its position by implant splint for avoiding occlusal forces on the implant during the healing phase (Fig. 11.31).

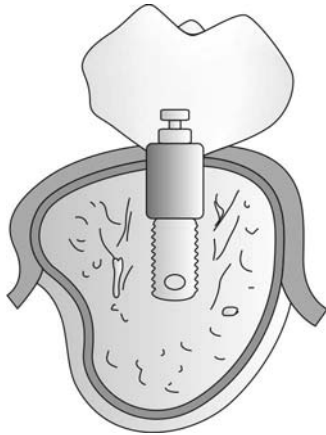


Fig. 11.31: One stage procedure

- ii. *Two-stage procedure:* Here, multicomponent implant is used. During the first surgery the implant body is inserted into the jaw and covered fully with the mucoperiosteum (Fig. 11.32), for six week to allow osteo-integration to take place. After six weeks the mucoperiosteum is again reflected to expose the implant and the prosthetic component is now fixed to it (Figs 11.33 and 11.34).

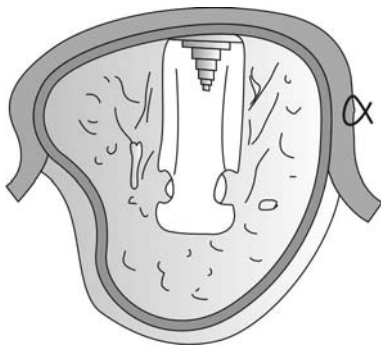


Fig. 11.32: Two stage procedure: Sealing screw (First- stage)

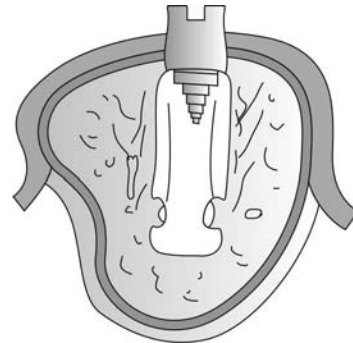


Fig. 11.33: Two stage procedure: Healing cap (Second stage)

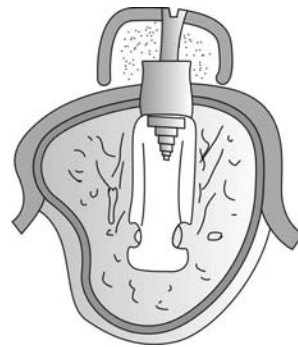
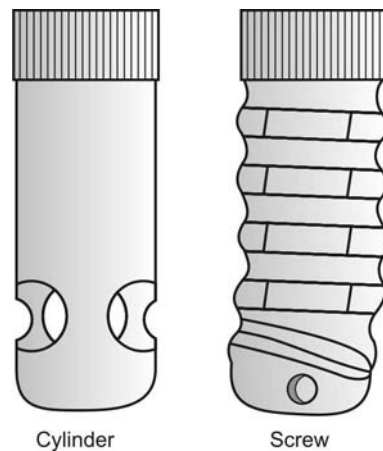


Fig. 11.34: Two stage procedure: Implant-impression post (second stage)



Cylinder

Screw

Fig. 11.35: Two-stage root form endosteal implants

Comparison of Screw Type and Cylinder Type Endosteal Implants

<i>Screw type (threaded)</i>	<i>Cylinder type (press - fit)</i>
– Turned into the site within the bone following preparation of the site. – 30-500 percent greater surface area than cylinder type, thus greater bone contact – Requires greater force for placement.	– A press - fit implant has smooth walls and is topped into the site. – Less surface are, less contact area. – A cylinder implant may be pressed into the bone by hand in hard and soft bone.

Advantages of Two-stage Osteointegrated Cylinder Implants

1. Surgical:
 - i. Documented success rate.
 - ii. In-office procedure.
 - iii. Adaptable to multiple intraoral locations.
 - iv. Precise implant site preparation.
 - v. Reversibility in the event of implant failure.
2. Prosthetic:
 - i. Multiple restorative options.
 - ii. Versatility of second - stage components.
 - a. angle correction
 - b. esthetic
 - c. crown contour
 - d. screw - or cement - retained restorations
 - iii. Retrievalability in the event of prosthodontic failure.

2. Subperiosteal implant insertion

This method is used for complete ridge or unilateral ridge reconstruction.

In this procedure the mucoperiosteal flap is reflected and impression is made to fabricate and place a metal framework below the periosteum and stabilize it by suturing the mucoperiosteum over it.

3. Transosteal impression insertion

This is an extraoral method and is done under general anesthesia. Holes are drilled on the lower border of the mandible and implant is placed to reach the intraoral site over the ridge.

Potential Problems With Tooth and Implant Supported Fixed Partial Dentures

1. Breakdown of osseointegration
2. Cement failure on natural abutment.
3. Screw or abutment loosening
4. Failure of implant prosthetic component.

Complications of an Implant

1. *Periimplantitis*: It is an inflammatory reaction with loss of supporting bone in the tissue surrounding a functioning implant. This is caused due to overloading an oral implant or due to microbial invasion in the area or due to poor host resistance.

Features

- “Saucer-shaped” vertical bone loss
- Periimplant pocket formation
- Bleeding and suppuration on probing
- Inflammatory features of swelling, redness and pain in the tissues
- Mobility of the implant.

Management

- Mechanical and chemical destruction of the microorganisms near the implant.
 - Maintaining proper oral hygiene and plaque control.
 - Re-osseointegration done if needed
2. *Periimplant mucositis*: It is a reversible localized inflammation of the soft tissues around the implant caused due to impinging or irritation caused by the implant. This is a reversible condition and required only supportive treatment.

Indications of Implant Removal

1. Severe periimplant bone loss
2. Bone loss involving implant vents or holes.
3. Unfavourable and advanced bone defects-one wall bone defects.
4. Rapid, severe bone destruction.
5. When non surgical or surgical therapy is ineffective.
6. Esthetic area precluding implant surface exposure.

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Surgical Procedures in Endodontics– Endodontic Surgery

12

Endodontic surgeries are the surgical procedures performed to remove the causative agent of periradicular pathosis and to restore the periodontium to a state of biologic and functional health.

Classification of Various Endodontic Surgical Procedures

- I. Surgical drainage:-
 1. Incision and drainage.
 2. Cortical trephination (fistulative surgery)
- II. Periradicular surgery:-
 1. Curettage
 2. Biopsy
 3. Root end resection
 4. Root end preparation and filling
 5. Corrective surgery
 - i. Perforation repair
 - a. mechanical (Iatrogenic)
 - b. resorptive (internal and external)
 - ii. Root resection
 - iii. Hemisection
- III. Replacement surgery (extraction/replantation)
- IV. Implant surgery
 1. Endodontic implants
 2. Root from Osseo-integration implant.

Indications

1. Conditions in which direct access to apical 3rd of canal is obstructed due to

calcifications, anatomic deformity, dilacerations, instrument obstruction.

2. Perforations caused in the canal due to resorption or iatrogenic.
3. Large periradicular disease (abscess) needing drainage.
4. Need of abscess drainage.
5. Re-implantation of avulsed tooth.
6. Intentional re-implantation.
7. Patient's not willing to come for appointments (less time consulting)
8. Predicted failure cases.
9. Numerous failed endodontically treated teeth need re-treatment.
10. Necessity for diagnostic biopsy
11. Horizontal fracture of root tip with periapical disease.
12. Need of radisectomy to treat furcation involvement.
13. Gross over filling of root canal leading to inflammation of periapical tissues.
14. Foreign body or broken instrument in periapical region leading to inflammation.

Contraindications

1. Medically compromised patients.
2. Emotionally distressed patients.
3. Limitation of surgeon's skill
4. Local
 - i. Localized acute inflammation.

- ii. Anatomic considerations (teeth nearing sinus, neurological bundles, mental canal, Mandibular canal).
- iii. Inaccessible surgical site (especially posterior teeth with curved roots).
- iv. Teeth with poor prognosis (e.g., short root, periodontal disease, vertical fracture, unrestorable teeth).
- v. Conditions where traumatic occlusion can not be corrected.

Classification of Surgical Flaps

- I. Full mucoperiosteal flaps
Includes all gingiva. These flaps are further classified into:
 - a. Triangular flap (one vertical releasing incision) (Fig. 12.1).
 - b. Rectangular flap (two vertical releasing incision).
 - c. Trapezoidal flap (broad base rectangular) (Fig. 12.2)
 - d. Horizontal flap (no vertical incision)

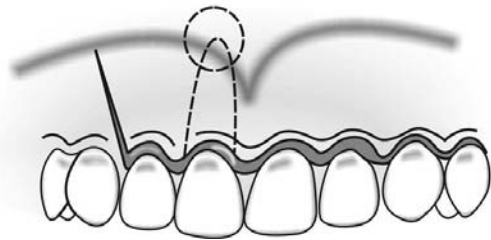


Fig. 12.1: Triangular flap

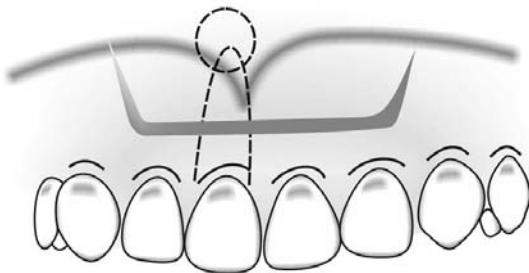


Fig. 12.2: Trapezoidal flap

II. Mucoperiosteal flaps (limited)

This flap does not include marginal and interdental gingiva.

- a. Submarginal curved (semi lunar flap)
- b. Submarginal scalloped rectangular (Luebke-Ochsenbein flap).

Reflection of flap is done following the principles of flap design as discussed under 'Exodontia'.

Semi Lunar Flap (Sub-marginal curved incision)

It is a type of limited mucoperiosteal flaps (Fig. 12.3).

Indications

- 1. When attached gingiva is to be maintained.
- 2. There is no pathosis in 2-3 mm from gingival sulcus.
- 3. Modified semilunar incision is made to preserve labial frenum.

Advantages

- 1. It is simple and easy.
- 2. It provides access to the apex without impinging on tissues.
- 3. The width of the attached gingiva is maintained.
- 4. Better oral hygiene is maintained.

Disadvantages

- 1. Visibility is less.
- 2. There are greater chances of flap margin tear.
- 3. It can result in dehiscence and scar formation, if incision is placed over any bony defect.
- 4. Its use is limited if muscle or any other prominent structure like canine eminence is present.

Luebke-Ochsenbein Flap (Submarginal scalloped incision)

It is a limited mucoperiosteal flap which was named after Luebke, an endodontist and



Fig. 12.3: Semilunar flap

Ochsenbein, a periodontist who discovered it. It is a modified semi lunar flap with scalloped horizontal incision and two vertical incision. Scalloped incision is placed on the attached gingival parallel to the free gingival groove, and should be 3-4 mm short of gingival margin (Fig. 12.4).

Advantages

1. Greater accessibility and visibility.
2. Easy reflected and sutured.
3. Decreased chances of dehiscence (as there is decreased chances of placing incision over bony defect).
4. Marginal gingiva is not affected.

The disadvantage is that there is scar formation if incision judgment is not proper.

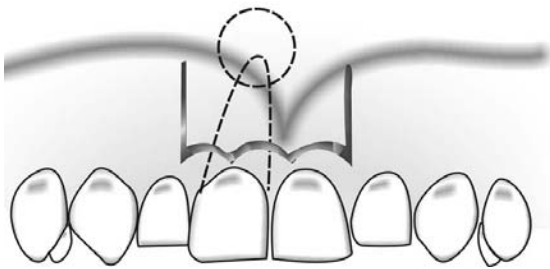


Fig. 12.4: Leubke-ochsenbein flap

STUDY OF INDIVIDUAL ENDODONTIC SURGICAL PROCEDURES

I. Apicoectomy with or Without Retrograde Filling

Apicoectomy also called as root resection or root amputation. It is the abrasion (cutting off) of the apical portion of a tooth and curettage of all periapical necrotic and inflammation tissue (Fig. 12.5).

Indications and contraindications are same as that of endodontic surgeries.

Procedure

The procedure of apicoectomy can be done in two methods:

- i. Over orthograde filling followed by apicoectomy, or
- ii. Apicoectomy followed by retrograde filling

The steps of apicoectomy are as follows:

- Radiographs are taken to determine the length of the root and its approximately to other structures.
- Administer anesthesia
- On the labial surface of the tooth, mark with the help of a periosteal elevator the root apex, so that incision can be placed.
- Place semilunar incision, from apex of the mesial tooth, extending down to 2/3rd of the infected tooth and then to the apex of distal tooth (Fig. 12.5).
- Reflect the flap.
- Several small openings are made on the labial cortical plate and the holes are joined to remove the labial plate.
- Root apex is exposed, then cut off the apex of the tooth with a fissure bur about 1/3rd of its length.
- Curette the surrounding pathologic tissues and round off the end of the cut root.
- For retrograde filling, a bevel of 0°- 10° is given such that it increases accessibility and should include all necessary canal (Fig. 12.6).

- Retrograde filling of the canal till 3 mm is done(Fig. 12.7).
- Irrigate the wound and suture the flap in position.

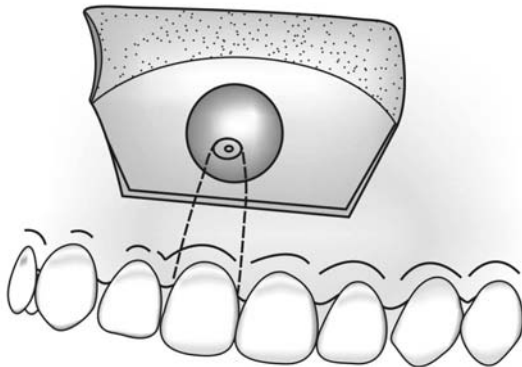


Fig. 12.5: Apicoectomy

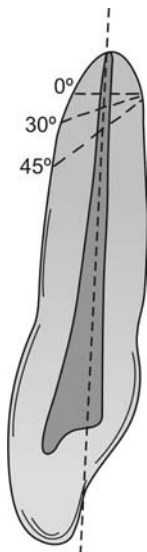


Fig. 12.6: Angles of apicoectomy

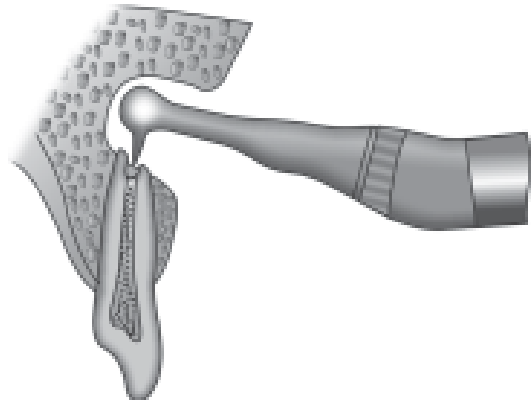


Fig. 12.7: Retrograde filling

Materials used for retrograde filling are:

Earlier used:

1. Amalgam (zinc free)
2. Gutta percha (thermoplastic)
3. Gold foil
4. Titanium screw
5. Cavity
6. Polycarboxylate.

Recently used:

1. Glass ionomer cement
2. Zinc oxide eugenol
3. Composite
4. H.E.M.A
5. Bone cement
6. E.B.A
7. MTA (mineral trioxide aggregate)

Post-operative Instructions

Patients should be instructed to follow all instructions after an extraction along with it, the following:

1. Do not raise the lip to look at the suture.
2. Place an icepack on the outside of the face 20 min. out of every 1½ hour for the first day of surgery.

3. Instruct to do salt water rinsing 3 times daily preferably after meal.
4. Do not chew any hard food with the tooth for 1 week.
5. Do not brush in the area of surgery for 1 week.
6. Maintain good oral hygiene.
7. Soft diet is suggested for the first 4 days.

Complications

They are:

- I. Intra-operative
 1. Bleeding by damage to the neighboring root.
 2. Entry into the sinus or inferior alveolar canal.
- II. Post-operative
 1. Abscess formation
 2. Fenestration
 3. Sinus tract formation
 4. Increased mobility of the tooth.

INTENTIONAL REPLANTATION

It is the intentional removal of a tooth and its re-insertion into the socket after orthograde obturation and resectioning of the root tip or resection of the root tip followed by retrograde obturation, an operation usually limited to posterior tooth.

Indications for this procedure are:

- A high risk of paraesthesia with standard apicoectomy techniques because of approximation of the roots to the inferior alveolar canal.
- Thick external oblique ridge in the molar area making access difficult or impossible.
- Poor access for conventional apicoectomy - mouth size, a high vestibule or a large bulging buccal fat pad.
- It is a time saving procedure (single sitting).

Contraindications

- Poor periodontal condition
- Furcation involvement
- Widely divergent or curved roots
- Litigious patients
- Tooth nearing vital structures
- Poor systemic health of the patient.

Procedure

Two person or operator is required for intentional replantation.

- 1st operator - extraction of the tooth and care of the wound and socket.
- 2nd operator - endodontic treatment and replacement of tooth in socket.

The steps are similar to extraction and endodontic treatment with root resectioning. Apicoectomy is performed of 2-3 mm and then splinting of the tooth is done. This procedure is completed in 15 minutes with periodontal ligament being vital.

BICUSPIDIZATION

It is process in which a tooth is divided into mesial and distal half without removal of any. Endodontic treatment is done and two separate crowns are fixed on both halves. It is performed in Mandibular molars with furcation involvement. Better stability of the tooth is achieved when there roots are divergent (Fig. 12.8).

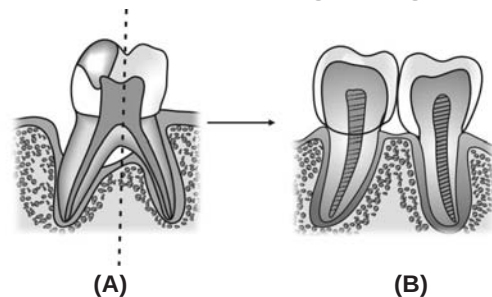


Fig. 12.8: Bicuspidization

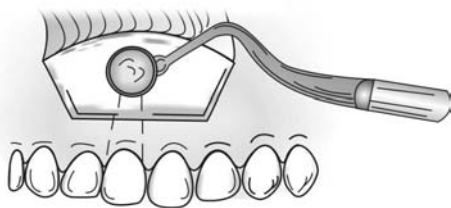


Fig. 12.9: Trephination

HEMISECTIONING

This process is similar to that of bicuspidization except that one half of the tooth is removed and the other half is endodontically treated, which acts as an abutment.

TREPHINATION

- Trephination is the creation of a surgical passage in the region of the root apex, usually by a bur or special drill (Fig. 12.9).
- The purpose of trephination is to provide a channel for the escape of pus and blood to relieve the pressure of accumulated fluid or gas in the jaw bone.

It has been advocated in:

1. Acute alveolar abscess where drainage is inadequate through root canal.
2. Teeth with large areas of rarefaction
3. When the root canal has been overfilled and pain or discomfort is present
4. For postoperative pain following obturation of the canal by conventional means.

ENDODONTIC MICROSURGERY

These are surgical procedures used for small and complex structures with the aid of an operating microscope. The triad of magnification, illumination and micro instruments provides the greater accuracy required.

Sl. No.	Procedure	Traditional surgery	Microsurgery
1.	Identification of the apex	Sometimes difficult	Precise
2.	Osteotomy	Large (≥ 10 mm)	Small (≤ 5 mm)
3.	Root surface inspection	Imprecise	Precise
4.	Bevel angle	Large (45°)	Small ($\leq 10^\circ$)
5.	Isthmus identification	Nearly impossible	Customary
6.	Retro preparation	Approximate	Precise
7.	Root end filling	Imprecise	Precise

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Maxillary Sinus and Its Disorders

13

Paranasal sinuses are air filled spaces, lined with mucous membrane, within some of the bones of the skull. They open into the nasal cavity, via the meatuses and are named according to the bone in which they are situated. They comprise the frontal sinuses and the maxillary sinuses (one pair of each), the ethmoidal sinuses (consisting of many spaces inside the ethmoidal bone), and the two sphenoidal sinus (Figs 13.1 and 13.2).

Anatomy of Maxillary Sinus

Maxillary sinus is the largest of all the paranasal sinuses present within the body of maxilla. It is pyramidal in shape, with its base directed medially towards the lateral wall of the nose, and its apex directed laterally to the zygomatic process of the maxilla. The boundaries of the maxillary sinus are:

- Medial wall or base = by lateral wall of the nasal cavity.
- Apex = Extends into or beyond the zygomatic process of maxilla
- Anterior wall = by anterior or facial wall of maxilla
- Posterior wall = by infra temporal surface of maxilla

- Roof wall = by orbital surface of maxilla
- Floor = by alveolar process of maxilla.

The upper part of the maxillary sinus opens into the middle meatus of the nose via an ostium and a thin mucous membrane is continuous through the aperture of the sinus into the lining of the nasal fossa.

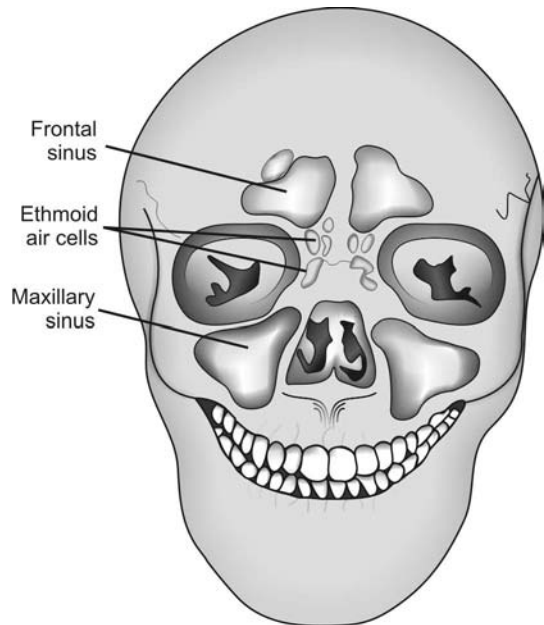


Fig. 13.1: Front view of all paranasal sinuses

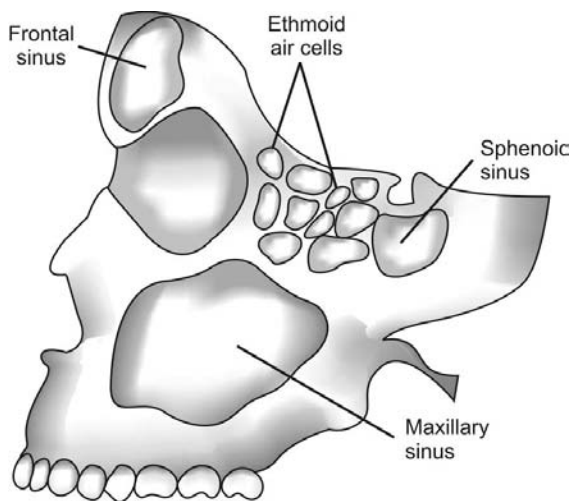


Fig. 13.2: Paranasal sinuses and their location

Functions of Maxillary Sinus

1. Makes the cranium bone lighter in weight
2. Acts as a resonant bone
3. Regulates the temperature of the inspired air
4. Drainage
5. Pneumatization

Classification of the Disorders of Maxillary Sinus

1. Infection/Inflammatory:-
 - i. Acute sinusitis
 - ii. Chronic sinusitis
2. Trauma
 - i. Oro-antral communication
 - ii. Fracture of the maxillofacial skeleton
 - iii. Foreign bodies within the antrum
3. Cysts and tumors
4. Other bony abnormalities:
 - i. Fibrous dysplasia
 - ii. Paget's disease
 - iii. Osteopetrosis

Diagnosis of the Disorders of Maxillary Sinus

The diagnosis of the disorders is done by the combination of following methods:

1. Proper case history and clinical evaluation
2. *Rhinoscopy* - Examination of the maxillary sinus via the nasal cavity using nasal spectrum and headlights or mirror.
3. *Nasoendoscopy* - Narrow fiberoptic endoscopes are used.
4. *Transillumination test*: It is a clinical test to detect the abnormalities of the maxillary sinus, but is less confirmatory than radiographs. Here, a 4 V electric lamp or a small torch is kept intraorally of the patient in a dark room and the light rays emitted are examined. In case of a normal sinus, the pupil shows luminous glow and infra orbital crescent of light is seen. In case of any pathology no such light is emitted.
5. Bacteriological and cytological study of the aspirates
6. *Radiography*: Intraoral and extraoral radiographical techniques are used like occlusal radiographs, water's projection, tomography, MRI, ultrasound, scintigraphy.

STUDY OF SOME MAXILLARY SINUS DISORDERS

Maxillary Sinusitis

Inflammation of the mucous of the maxillary sinus is called as maxillary sinusitis.

If all sinuses (maxillary, frontal, ethmoidal and sphenoidal) are involved, it is called as Pan sinusitis.

Types

1. Acute maxillary sinusitis: It is sudden in onset and persists for less than 4 weeks. Needs only short term therapy.
2. Subacute maxillary sinusitis: Features persists for 4-12 weeks.
3. Chronic maxillary sinusitis: Features persists for more than 12 weeks. May need surgical correction swell.

Acute Maxillary Sinusitis

Etiopathogenesis: Viral conditions like influenza, coryza, exanthematous fever, etc. effecting the upper respiratory tract leads to altering of the mucociliary function or sinus epithelium, which predisposes it to secondary bacterial infections like *Hemophilus influenza*, *Pneumococci*, *Streptococcus pneumoniae*.

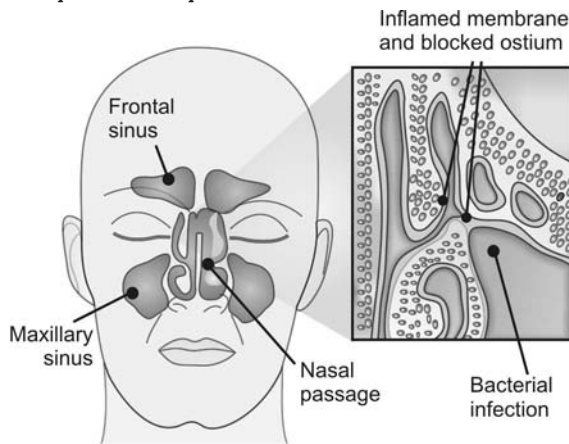


Fig. 13.3: Sinusitis (For color version see plate 4)

Dental causes causing maxillary sinusitis:-

- i. Oroantral communication
- ii. Apical osteitis
- iii. Radicular cyst and residual cyst
- iv. Periodontal pockets
- v. Impacted teeth
- vi. Foreign body in sinus.

Other causes

- i. Nasal infection due to nasal obstruction
- ii. Nasal allergy
- iii. Blowing nose strongly
- iv. Trauma (especially barotrauma)
- v. Swimming and diving in infected water

Clinical Features

1. Continuous nagging pain over antral cavity and headache
2. Facial pain and swelling
3. Nasal blockage with continuous purulent unilateral nasal discharge

4. Fever, chill, fatigue, cough, sneezing
5. Fetid odour and halitosis due to fistulous discharge
6. Tenderness on percussion over maxillary tooth of involved area.

Management

Proper diagnosis by combination of earlier mentioned methods.

Antral regime should be followed, this includes:

1. **Nasal decongestants:** 0.5 percent - 1 percent ephedrine sulfate, in normal saline every 6th hourly or 0.1 percent Xylometozolin hydrochloride, can be used as nasal drops. Tincture Benzoin or carvol, can be used as inhalation.
2. **Antibiotics:** Procaine penicillin, Amoxicillin, clavulanic acid or cephalosporine can be given either by oral or parenteral route.
3. **Mucolytics:** Camphor, chlorbutal, menthol or karrol capsules can be used to provide easy drainage of the mucous by making it into a less viscous secretion.
4. **Analgesics:** Paracetamol 500 mg - 750 mg or other NSAIDs can be used to reduce pains.

An adjuvant of antihistamines like cetirizine and topical corticosteroids can also be used to give faster relief. Steam inhalation and hot fermentation is also helpful.

Chronic Maxillary Sinusitis

Etiopathogenesis

The normal mucosal ciliary tissues become hypertrophic (polypoidal) or atrophic (sclerosed) due to prolonged neglected dental infection or other focus of infection.

Clinical Features

May be asymptomatic or with mild symptoms of fever, tiredness, facial pain, headache, nasal

obstruction with prolonged mucopurulent discharge which does not subside despite antibiotic therapy.

Complication

- Infection of eyelid
- Orbital abscess
- Restricted eye movement and vision affected
- Osteomyelitis of bone
- Intracranial complications like meningitis, encephalitis, extradural abscess and cavernous sinus thrombosis
- Descending infection like otitis media, pharyngitis, tonsillitis, laryngitis and tracheobronchitis

Management

After proper diagnosis an adjuvant pharmacologic regime is recommended as in case of acute sinusitis to reduce the symptoms.

The focus of infection - either long standing dental infection, foreign body in sinus or oro-antral fistula should be treated.

The purulent content should be properly drained, either by irrigating in with antiseptic saline solution or by surgical drainage - using Caldwell Luc technique or nasal antrostomy or functional endoscopic sinus surgery(FESS)

Nasal Antrostomy

In this procedure a nasal antral window is made using nasal rasp under the inferior meatus for establishing a more dependent drainage. This is done in conditions where natural ostium is obstructed due to inflammation. Use of mucolytics further facilitates sinus drainage. After this antral packing with iodoform gauge for 4-7 days is done.

Caldwell-Luc Operation

It is a procedure of reaching the maxillary sinus via intraoral approach for various reasons.

Indications

1. Retrieval of root or tooth from sinus
2. Enucleation of odontogenic cyst from sinus
3. Removal of odontogenic tumors from sinus
4. Treatment of chronic maxillary sinusitis
5. Management of oroantral fistula
6. Repair of fracture of orbital floor or zygoma
7. Management of hematomas of the sinus with active bleeding through the nose.

Procedures

1. Mostly done under general anesthesia after proper preoperative dental corrections are done.
2. An intraoral incision of 2.5 cm is made along the mucogingival sulcus in the canine fossa, lateral to upper canine and above the first premolar (Fig. 13.4).
3. A hole is made at the centre of the canine fossa of the size of index finger using a bone gauge and ronguer (Figs 13.5 and 13.6).
4. Blood and pus is drained from the sinus, foreign bodies are removed and only the diseased mucosa is removed by antral curette.
5. Cavity is cleaned and soft tissues flap is replaced and sutured over the bone.
6. Nasal decongestants are recommended preoperative and postoperative to shrink the mucous membrane, thereby preventing development of gross edema.

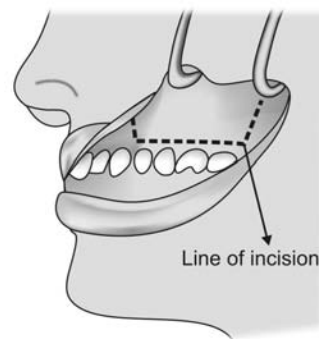


Fig. 13.4: Caldwell-luc operation – incision line

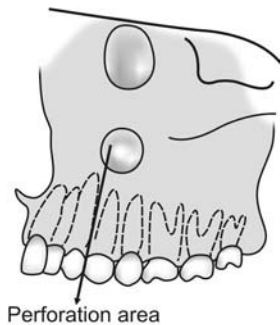


Fig. 13.5: Bone of maxillary sinus exposed

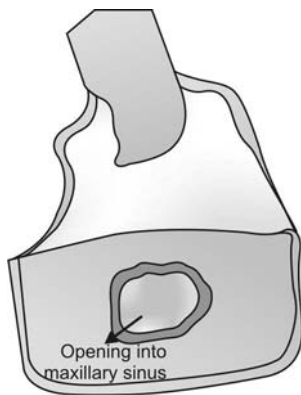


Fig. 13.6: Maxillary sinus reached

Postoperative Complications

1. Recurrent sinusitis
2. Protracted numbness of lips, cheek and gingival
3. Oroantral fistula
4. Persistent cheek swelling.

Foreign Bodies within the Antrum

The details of the causes, diagnosis and management of this has been described under complications of exodontia.

Oro-antral Communications (Oro-antral Fistula)

It is an unnatural communication between the oral cavity and maxillary sinus.

Etiology

1. Pushing of tooth or root into the sinus while extracting it (most common)
2. Periapical abscess, leading to destruction of bony floor of sinus
3. Improper use of instruments leading to damage of sinus floor.
4. Trauma to face
5. Surgical removal of cysts, polyp or tumor of maxillary sinus
6. Osteomyelitis of sinus
7. Infected maxillary implant denture
8. Malignant diseases

Clinical Features

1. *Symptoms:*
 - i. Nasal discharge from posterior region of nasopharynx into the mouth, leading to fowl taste.
 - ii. Epistaxis (unilateral bleeding from nose)
 - iii. Change in voice due to enhanced column of air
 - iv. Pain in the region
 - v. Popping out of an antral polyp in chronic cases
2. *Signs:*
 - i. Tenderness over maxilla
 - ii. Edema over cheek and infraorbital region.
 - iii. Otitis media (middle ear infection)
 - iv. Fowl odour and halitosis
 - v. Nasal congestion

Diagnosis

- Part of bony floor of sinus seen along with extracted tooth apex
 - Close nose and blow inward, bubbling of air in the oral opening of fistula or the blowing of cotton kept in the area is seen
 - Radiographic evaluation
 - Rhinoscopy
- Never probe or irrigate the area or blow nose, as it can lead to confirmation of fistula opening and spread of infection in the area.

Treatment

The treatment of oro-antral fistula aims at:

1. Protect sinus from microorganism
2. Prevent escaped of fluid via communication
3. Establish drainage via inferior meatus
4. Eliminate existing pathology of sinus

Treatment of early cases (Iatrogenic opening) (where fistula has not formed and only communication has occurred): Immediate primary closure by sliding buccal flap and acquiring enough soft tissues to cover the whole opening (Fig. 13.7). Supportive treatment of decongestants, mucolytics, antibiotics and analgesics is recommended.



Fig. 13.7: Sliding buccal flap

Treatment measures to prolong surgical closure, especially when root piece has to be retrieved at a later date:-

This is done by following ways:

1. Gauge packed in medicaments like white head varnish is sutured and held in the position till surgery.
2. Acrylic stent is placed in position till surgery.

Treatment of delayed cases (chronic fistula):

1. If patient comes within 24 hours then the edge is cleaned and primary closure is achieved by sliding buccal flap technique.
2. If patient comes after 24 hours then postpone the treatment for 3-4 weeks until the gingiva has healed and fit for surgical procedure.

3. If patient comes after gingival has healed (chronic fistula) then surgical closure of the opening along with Caldwell Luc operation to retrieve root piece or to drain out the pus is done. The surgical closure can be done by advancing either buccal flap or palatal flap by combination of buccal and palatal flap.

- i. Buccal flap advancement procedure (Von Rehrmann flap): After excising the whole fistulous tract along with some soft tissue margin (Fig. 13.8), a trapezoidal buccal flap is reflected to close the whole opening (Fig. 13.9). Sutures are placed over firm bone and post operative care are taken (Fig. 13.10).



Fig. 13.8: Excision of fistula



Fig. 13.9: Buccal flap reflected

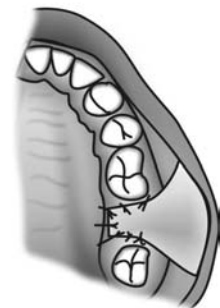


Fig. 13.10: Buccal flap sutured

- ii. Palatal flap advancement procedure: After excising the whole fistulous tract along with same soft tissue margin, a palatal flap of enough length and containing the anterior palatine artery for providing adequate blood supply is reflected (Fig. 13.11). This flap is then rotated and sutured over firm bone to cover the whole opening (Fig. 13.12). Iodoform gauge is placed over the raw healing palate and proper post operative care is taken (Fig. 13.13).

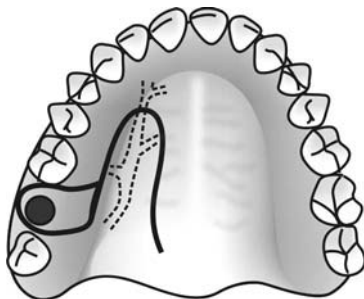


Fig. 13.11: Incision of flap

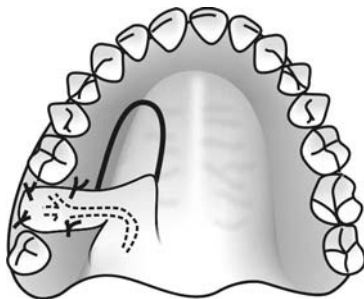


Fig. 13.12: Reflection of flap

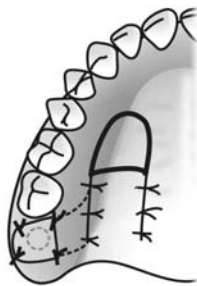


Fig. 13.13: Flap sutured

- iii. Metallic - foil closure of oroantral communication: Both facial and palatal mucoperiosteal flaps are reflected and the whole fistulous tract along with its margins are excised (Fig. 13.14). A metallic - foil "Patch" (usually gold foil) is adapted to cover the whole defect and positioned between alveolar process and overlying buccal and palatal mucoperiosteal flaps. The mucoperiosteal flap is then repositioned and sutured over the foil (Fig. 13.15).

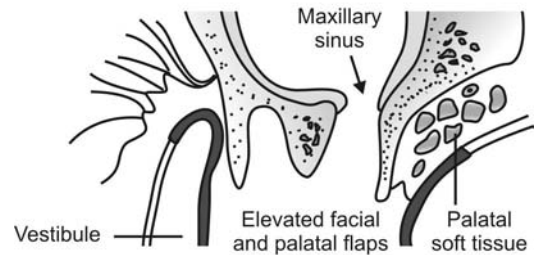


Fig. 13.14

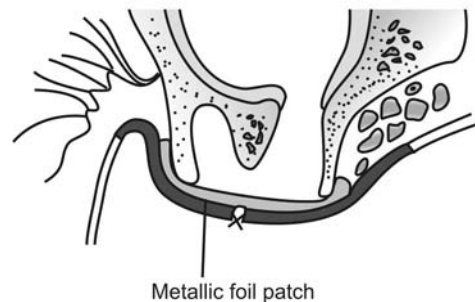


Fig. 13.15

Functional Endoscopic Sinus Surgery (FESS)

It is a minimally invasive technique where the sinus air cells and sinus ostia are opened under direct visualization to restore the normal functions of the paranasal air sinuses with

mucocilliary activity. This procedure aims in identifying and correcting the primary cause of the disease, secondary disease in sinus will often improve spontaneously.

Advantages over conventional sinus surgery:-

1. Surgery is less extensive
2. Less removal of normal tissues
3. Surgery can be performed on an outpatient basis without the need for nasal packing.
4. Better visualization is obtained during surgery by the use of endoscopes.

Indications for FESS:

1. Chronic sinusitis
2. Nasal polyposis
3. Sinus mucocoeles
4. Excision of selected tumors

5. CSF leak closure
6. Orbital decompression
7. Optic nerve decompression
8. Foreign body removal
9. Epistaxis control
10. Orbital abscess and cellulitis.

FURTHER READING

1. Anon, Rontal, Zinreich — Anatomy of paranasal sinuses.
2. Archer WH — Oral and maxillofacial surgery 5th ed, Vol. 2.
3. Gustov O Kruger — Textbook of oral and maxillofacial surgery, 6th ed.
4. Peterson, Ellis, Hupp, Tucker — Contemporary oral and maxillofacial surgery, 4th ed, 2006.
5. Stranding — Gray's anatomy, 39th ed.

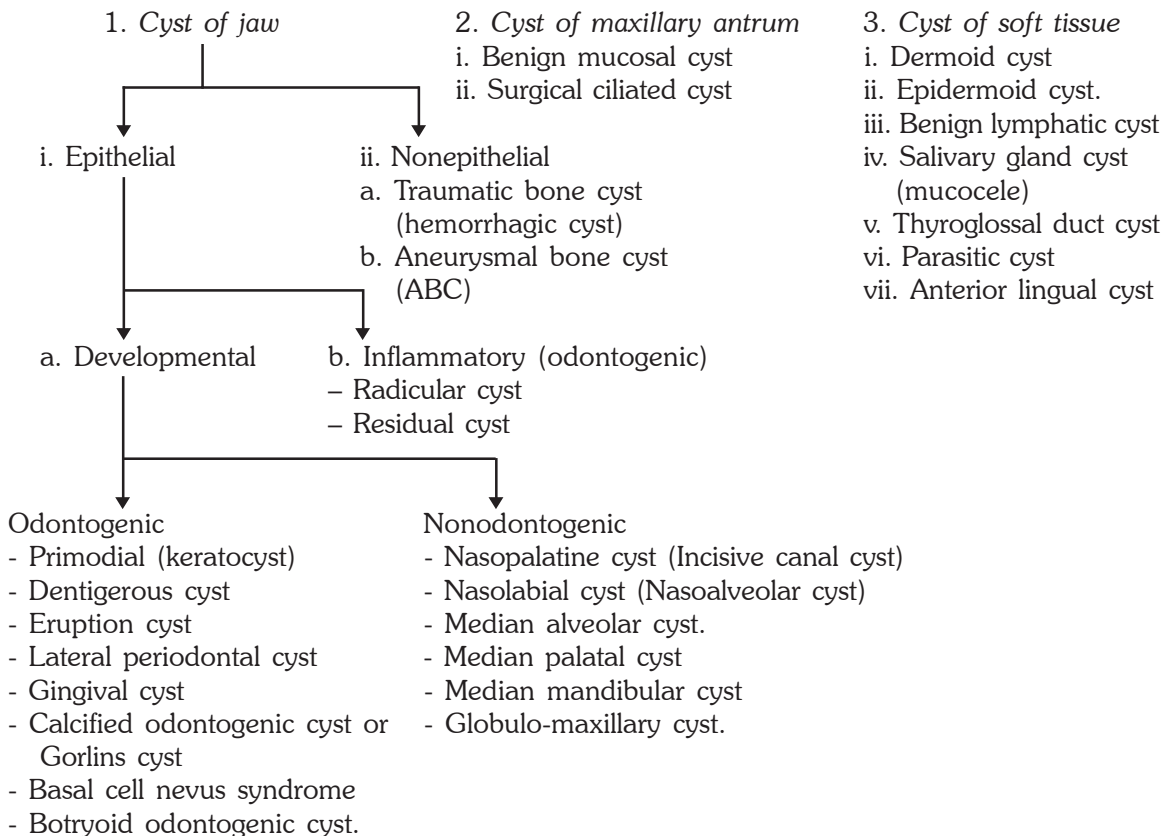
Cysts of the Oral Cavity

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A cyst is a pathological cavity or sac with the hard or soft tissue. Lined by epithelial or non epithelial tissue and containing fluid, semi fluid or gaseous content.

CLASSIFICATION OF OROFACIAL CYSTS

A. By Shear and Kramer



B. By Harris and Seward

1. Odontogenic epithelial cysts:-
 - I. Derived from dental lamina.
 - i. Kertocysts.
 - a. Solitary or primordial cyst
 - b. Pseudofollicular or extrafollicular dentigenous cyst.
 - ii. Calcified odontogenic cyst (Gorlin's cyst)
 - II. Derived from reduced enamel epithelium
 - i. Eruption cyst
 - ii. Follicular or Dentigerous cyst
 - a. Pericoronal
 - b. Lateral
 - c. Residual
 - III. Derived from epithelial rest of Malssez
 - i. Inflammatory periodontal (Radicular)
 - a. Apical
 - b. Lateral
 - c. Residual
2. Non-odontogenic epithelial cyst (fissural)
 - I. Nasopalatine cyst
 - II. Nasolabial cyst
3. Bone cysts - (cyst without epithelial lining)
 - I. Solitary bone cyst
 - II. Aneurysmal bone cyst

PATHOGENESIS OF CYST FORMATION

There are mainly two stages in cyst formation:-

1. *Initiation*: There are various initiating cells like dental lamina, epithelial rest of Malassez, reduced enamel epithelium or bony tissues which initiates the cystic cavity formation.
2. *Enlargement*: A cystic lesion expands in a balloon-like manner resorbing the surrounding bone, the expansile force being created by an accumulation of intra cystic content which is:
 - i. Cyst epithelium and its products of autolysis
 - ii. Plasma proteins derived from transudation, exudation and intracystic hemorrhage.
 - iii. Tissue fluids drawn into the cyst owing to the high osmolality created by (i) and (ii).
 - iv. Mucous secreted by the Goblet cells, which are formed in some follicular, and nasopalatine cyst wall.

DIAGNOSIS OF OROFACIAL CYSTS

The diagnosis of a cyst is done by the combination of following methods:

- History taking and clinical diagnosis.

DIAGNOSIS BY ASPIRATION

No.	Name of Pathology	Aspirate's Physical Features	Aspiration Other Features
1	Dentigenous cyst	- Clear pale, straw coloured fluid	- Cholesterol crystals. - Total protein exceeds 4.0 gm per 100 ml.
2	Odontogenic keratocyst (OKC)	- Dirty, creamy white viscous suspension	- Parakeratinised squamous - Total protein is less than 5.0 gm per 100 ml.
3	Periodontal cyst	- Clear, pale yellow strew coloured fluid	- Varying amount of cholesterol crystals. - Total protein content is between 5 gm and 11 gm per 100 ml.
4	Infected cyst	- Pus or brownish fluid, seropurulent/sanguine purulent fluid, at times paste like or caseous consistency.	- PMN leukocytes - Foam cells - Cholesterol clefts.
5	Mucocoele, Ranula	- Mucus	
6	Gingival cysts	- Clear fluid	
7	Solitary bone cyst	- Serous or sanguineous fluid, blood or empty cavity.	- Necrotic blood clot.
8	Stafne's bone cyst	- Empty cavity, will yield air.	
9	Dermoid cyst	- Thick sebaceous material.	
10	Fissural cyst	- Mucoïd fluid	
11	Vascular cyst walls	- Fresh blood.	

- Radiographic diagnosis to differentiate unilocular or multilocular cysts lined by radioopaque border of sclerotic bone.
- Histopathological diagnosis by biopsy procedures.
- Laboratory diagnosis.

TREATMENT OF AN OROFACIAL CYST

A cyst is mostly treated by surgical method as these lesions increase in size, destroys surrounding bone, weakens the jaw ultimately leading to pathological fracture, involve erupted or unerupted teeth or encroach upon important vital neighboring structures. Despite all these complications in certain cases surgical treatment is not preferred. These conditions are - small asymptomatic cysts or patients with complicated systemic illness.

The objectives of the treatment of a cyst are:-

1. Removal of the cyst lining or a device to position the abnormal tissue to ensure its elimination from the site.
2. Preservation and respect to the adjoining important structures.
3. Conservation of healthy teeth either erupted or unerupted.
4. Restoration of the affected area to its normal/original formula, shape as far as possible.

The various surgical procedures are:-

1. Marsupialization or decompression technique (Parsch I)
2. Enucleation technique:
 - Enucleation with primary closure.
 - Enucleation with packing
 - Enucleation with primary closure and reconstruction (graft surgery)
3. Combination of enucleation and marsupialization (Parsch II).

1. Marsupialization or Decompression Technique

It is a procedure of surgically creating a window in the cyst wall which is continuous with the

mucosa and then evacuating all of the cystic contents (Fig. 14.1).

Indications

- In case of large cysts located in inaccessible areas.
- In large cyst with weakened cystic wall
- For dentigerous cyst in young patient where teeth eruption is necessary.
- In patients where complicated surgeries are contraindicated.

Advantages

- It is a simpler and easy procedure.
- It spares the vital structures
- This procedure also allow the teeth to erupt.
- It requires less time.
- There is less blood loss in this procedure.
- It is a conservative method as it preserves bone height.

Disadvantages

- In this procedure, the pathological tissues are not completely removed.
- It takes increased healing time.
- It requires prolonged follow up
- There is greater chance of recurrence.

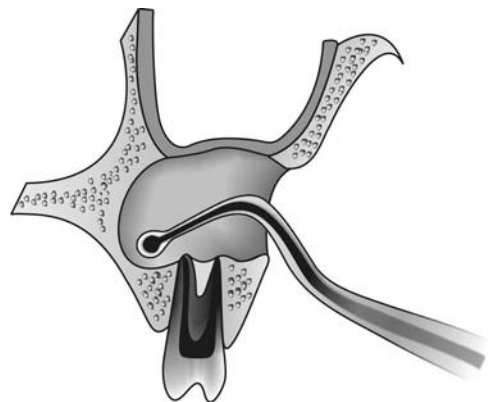


Fig. 14.1: Marsupialization

Procedure

The steps involved for marsupialization of a cyst are:

- Administration of anesthesia
- The cyst is aspirated
- An inverted V-shaped incision made around the cyst.
- The flap is reflected and the bone underlying is revealed.
- The bone is removed along with periosteum and the cyst lining.
- Irrigation of the wound is done.
- Suturing of the cyst lining to the edge of the oral mucosa is done.
- Pack the cystic cavity with gauze dipped in antibiotic ointment, iodoform, eugenol and white head varnish.
- Plugging of the cavity is done.
- Patient should be recalled for routine and regular follow up.

2. Enucleation

It is a process of surgically removing a complete cyst, tumor or an organ (Fig. 14.2).

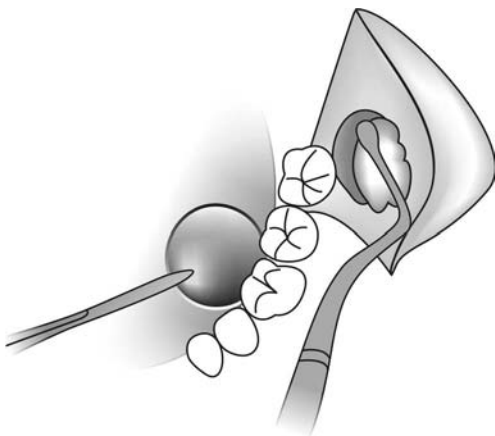


Fig. 14.2: Enucleation

Enucleation with primary closure: It is the complete removal of cyst with its epithelium lining

and the space fills with blood clot which is covered by the flap reflected (Fig. 14.3).

Indication

- For management of odontogenic keratocysts.
- In case of recurrent cysts.
- In small cysts

Advantages

- Healing is rapid if primary closure is attained.
- In this procedure, the complete cystic lining can be examined.
- Post-operative care is less.

Disadvantages

- In this case, the teeth have to be generally removed.
- This procedure, cannot be done if cyst is near vital structure like sinus or nerve bundles.
- This procedure weakens mandible and makes it prone to fracture.

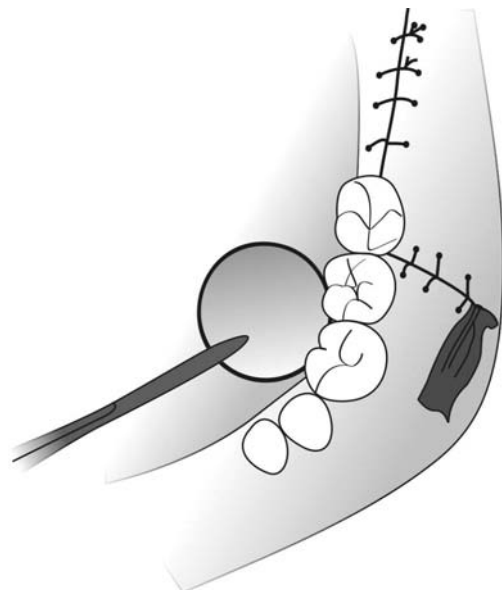


Fig. 14.3: Enucleation with primary closure

Procedure

The steps performed during primary closure are:

- Anesthesia administered.
- Incision is placed parallel to the cyst on hard bony structure either intraorally or extraorally.
- Reflection of mucoperiosteal flap is done.
- If required, then the overlying bone is removed.
- Then the cyst is separated from the attached structures.
- Complete retrieving of the cyst is done.
- Irrigation of the wound is done.
- Suture the flap back.

Enucleation with packing: The procedure of this technique is similar to that of primary closure and is indicated in conditions where large cyst removal is to be done and clot stabilization is difficult. Iodoform gauze or other antimicrobial packing is given which is regularly changed until the lesion shrinks, followed by primary closure (Fig. 14.4).

Enucleation with primary closure and reconstruction surgery: This procedure is done

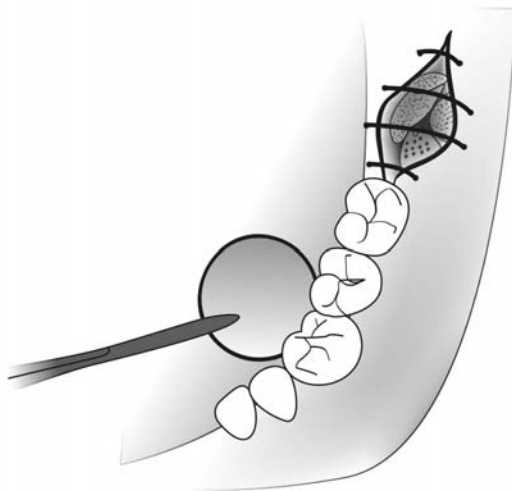


Fig. 14.4: Enucleation with packing

is case of large cyst removal using stainless steel or titanium reconstruction plates. Here autogenous bone grafts (iliac crest or rib) can be used which is immobilized by intermaxillary ligation and fixation.

3. Combination of Enucleation and Marsupialization (Partsch II)

This procedure is performed in case of large cyst removal. It is a Z stage procedure. It involves:

- Stage I—marsupialization, to allow shrinkage of cyst.
- Stage II—enucleation to remove the reduced cyst completely.

COMPLICATION OF TREATMENT

They are:

1. Edema and swelling
2. Infection
3. Hematoma
4. Neural injuries
5. Tooth being non-vital.
6. Oro antral and oro nasal fistula.
7. Pathological fracture.
8. Recurrence of cyst.
9. Malignant transformations.

In some case a more conservative approach is used, mainly to prolong the surgical procedure. This is chemical cauterization. For this the chemical solutions used are:

1. Carnoy's solution:-
 - 60 ml absolute alcohol
 - +
 - 30 ml chloroform
 - +
 - 10 ml acetic acid.
2. Phenol brushing followed by rinsing with 95 percent ethanol and saline.

Chemical cauterization is also used after the surgical process to prevent recurrence.

STUDY OF SOME COMMON OROFACIAL CYSTS

No. Name	Pathogenesis	Clinical features	Radiographic features	Treatment
1. Odontogenic keratocyst (OKC) or Primordial cyst.	Stellate reticulum in the enamel organ disintegrates to form a cystic cavity lined by inner and outer enamel epithelium cells.	-Mostly seen in young adult males. -Mandibular 3rd molar and supernumery tooth are most involved. - Rarely any other fractures seen except missing of tooth involved.	A well defined multilocular radiolucent area bounded by smooth cortical bone.	-Enucleation along with curratage is done. marsupialization is not done. -Block dissection with or without graft can also be done for large cysts. - Best method is to enucleate the cyst followed by excision of normal overlying mucosa or muscle and then chemical cauterization to prevent high recurrence.
2. Dentigerous cyst	Cystic proliferation of the cells between the dental crown of the involved impacted tooth and reduced enamel epithelium covering it leads to formation of cyst.	-Seen in any age and mostly in impacted mandibular 3rd molar. -Expansion and destruction of cortical bone leading to facial asymmetry.	3 varieties are there - central, lateral and circumferential.	- Marsupialization is done in case of large cyst present in children where tooth eruption is to be achieved, otherwise enucleation and extraction of involved tooth is done. Treatment aims at removal of cyst along with eruption of tooth involved, prevention of recurrence, prevention of amyloblastoma formation and symptomatic relief.
3. Mucocele	Two different pathogenesis are there- mucous extravasation due to trauma and mucous retardation due to obstruction in salivary gland.	-Dome shaped, circumscribed, bluish translucent swelling mostly in the lower lip. -Pain while swallowing -Xerostomia -In rare, deeper lesions there may be no signs seen.	-----	-Marsupialization and enucleation is not affective as recurrence is common. Thus, complete removal of gland is recommended.

Contd...

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No.	Name	Pathogenesis	Clinical features	Radiographic features	Treatment
4.	Ranula	Mucous extravasation type of cyst is there	-Similar to mucocoele but seen in submandibular region only.	-----	-Surgical removal of complete sublingual gland.
5.	Aneurysmal bone cyst (ABC)	A cystic cavity is formed mainly due to trauma, venous occlusion or hemodynamic disorders	-Seen at all ages. -Firm swelling which rapidly enlarges due to continued bleeding. -Tender, painful and displaced tooth.	-Honeycomb or soap bubble appearance is seen.	-Surgical curettage or excision of the lesion.
6.	Nasolabial cyst (Kledstat cyst)	Raminants of nasolacrimial duct develop into cysts swelling.	-Unilateral, often painless swelling is seen on the lip.	-----	-Surgical removal of the lesion.

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Tumors of the Oral Cavity and Oral Malignancies

15

According to Willis a tumor or neoplasm is an abnormal mass of tissue, the growth of which exceeds and is uncoordinated with that of the normal tissue and persists in the same excessive manner after cessation of the stimuli which evoke the change.

CLASSIFICATION OF ODONTOGENIC TUMORS

1. Tumors from epithelial origin:
 - i. Enameloma.
 - ii. Ameloblastoma.
 - iii. Adenomatoid odontogenic tumour (AOT)
 - iv. Calcified epithelial odontogenic tumor (CEOT) or Pindborg's tumor.
2. Tumors from mesenchymal origin:
 - i. Odontogenic fibroma.
 - ii. Odontogenic fibrosarcoma.
 - iii. Odontogenic myxoma
 - iv. Periapical cemental dysplasia (cementoma)
 - v. Central cementoifying fibroma.
 - vi. Dentinoma
3. Tumors from mixed origin:
 - i. Ameloblastic fibroma.
 - ii. Ameloblastic fibrosarcoma.
 - iii. Ameloblastic fibroodontoma
 - iv. Odontoma.
 - v. Ameloblastic odontoma
 - vi. Teratoma.

CLASSIFICATION OF NONODONTOGENIC TUMORS

1. Nonodontogenic tumors:
 - i. Central fibroma.
 - ii. Myxofibroma.
 - iii. Ossifying fibroma.
 - iv. Osteoma.
 - v. Osteoid osteoma
 - vi. Benign osteoblastoma
 - vii. Chondroma
 - viii. Giant cell granuloma
 - ix. Central hemangioma
 - x. Benign tumor of nerve tissue.
2. Fibro-osseous lesion:
 - i. Fibrous dysplasia of bone
 - ii. Cherubism
 - iii. Ossifying fibroma.
 - iv. Central giant cell granuloma.

DIAGNOSIS OF OROFACIAL TUMORS

The diagnosis of a tumor is done by the combination of following methods.

- History taking and clinical diagnosis.
- Radiographic diagnosis to differentiate unilocular or multilocular radiolucent and radio opaque lesions.
- Histopathological diagnosis by biopsy procedures.

TREATMENT OF OROFACIAL TUMORS

A conservative approach of curettage with chemical cauterization is followed in some cases but mostly a more severe surgical approach is to be done. These surgical approaches are:

1. Enucleation with or without curettage.
2. Marsupialization or Partsch operation.
3. Resection without continuity defect also known as marginal resection (EN Block resection) (Fig. 15.1).
4. Resection with continuity defect (the operation for extensive lesions include the inferior border of the mandible)
5. Partial resection or peripheral ostectomy.
6. Hemimandibulectomy with removal of condylar head (disarticulation) (Fig. 15.2).
7. The CO₂ laser and cryotherapy has been reported in the management of ameloblastoma in small lesion.

The treatment choice for the treatment of orofacial tumors depends on the fact that it should fulfill these goals:

1. Complete removable of lesion
2. Preservation of normal tissues
3. Restoring tissue anatomy and function.
4. Long term follow up and prevent recurrence.



Fig. 15.1: Resection without continuity defect (En block resection – Marginal resection)



Fig. 15.2: Resection with continuity defect

STUDY OF SOME COMMON OROFACIAL TUMORS

Sl.No.	Name of tumor	Clinical features	Radiographic features	Histological features	Treatment
1.	Ameloblastoma	- Seen mostly in middle aged people and involves mostly mandibular molar, ramus area. - Generally asymptomatic but rarely shows jaw expansion, tooth mobility and malocclusion. - May be intraosseous extraosseous or extraoral - pituitary ameloblastoma.	- Mostly diagnosed by radiographic fractures. - Unilocular or multilocular radiolucent area with scalloped sclerotic bone outline. Shows a 'soap bubble' or 'honeycomb' appearance.	- 7 Histological variations i. Follicular ii. Plexiform iii. Cystic iv. Basal cell v. Desmoplastic vi. Granular, and vii. Acanthomatous.	- Conservative treatment of curettage and cauterization is ineffective because of high recurrence rate. - Marginal or partial resectioning with or without reconstruction is recommended.

Contd...

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Sl.No.	Name of tumour	Clinical features	Radiographic features	Histological features	Treatment
2.	Central epithelial odontogenic tumor (CEOT) or Pindborg's tumor.	-Mostly seen in middle ages people and involves mostly mandibular 3rd molar and premolar - Generally asymptomatic but rarely shows painless expansion of bone.	-multilocular or unilocular radiolucent area with scalloped sclerotic bone outline and containing flecks of calcifications shows 'snow driven appearance'.	-Polyhedral cells arranged in sheaths with multinucleated giant cells, clear cells and Leisgang bodies are seen.	- Marginal or partial resectioning with or without reconstruction is recommended.
3.	Cementoma 4 types: i. Benign cemento-blastoma. (True cementoma)	-Mostly seen in people below 25 years and vital mandibular 1st molar is most involved. - Slow growing expansion of cortical bone and root resorption.	-Well defined solitary radio opaque lesion with surrounding radiolucent border and is attached to the root of the involved tooth.	-Sheaths of cemental like tissues resembling secondary cellular cementum and having reversal line, vascular and cellular elements.	-Enucleation and or curettage with or without removal of involved tooth.
	ii. Periapical cemental dysplasia	-Mostly seen in middle aged females and involves mostly mandibular incisions. -Mostly asymptomatic but rarely may show expansion of bone.	-Initially in the osteolytic stage it is a radiolucent lesions. -Then radio opaque spicules are seen on the radiolucent surface cementoblastic stage. -Finally is the maturitive stage it is completely radio opaque.	-Sheats of cemental like tissues resembling secondary cellular cementum is seen. As the stage increases, calcified spicules are seen.	-Enucleation and/or curettage with or without removal of tooth.
	iii. Gigantiform cementoma				
	iv. Other cemental lesions.				
4.	Odontoma 3 types: i. Complex cementoma.	-Irregular, simple, calcified dental mass with no morphological bearing to a tooth is seen or abnormal position. -Swelling, asymmetry and infection of jaw may be there otherwise mostly asymptomatic	-Shapeless, small, radio opaque mass with radiolucent border.	-Calcified mass with ghost cells is seen.	-Enucleation and/or curettage may be needed for prosthetic reasons or else no treatment is needed if asymptomatic.

Contd...

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Sl.No.	Name of tumour	Clinical features	Radiographic features	Histological features	Treatment
	ii. compound cementoma	-Structure similar to a natural tooth is seen on abnormal position, mostly on posterior tooth. - mostly asymptomatic	-Variable number of tooth like structure is seen.	-Normal appearing enamel, dentine, pulp and cementum is seen.	- Same as complex cementum.
	iii. Compound complex cementoma.	-Combination of (i) and (ii).	-Combination of (i) and (ii).	-Combination of (i) and (ii).	- Same as complex cementum.
5.	Myxoma.	-Mostly seen in middle aged people and involves mostly mandibular tooth. -mostly asymptomatic but sometimes may show hard slow growing swelling as facial asymmetry.	-Unilocular or multilocular mixed radio opaque and radiolucent lesion with well defined smooth or scalloped margin shows a 'Honeycomb' or 'soap bubble' appearance.	-Gelatinous texture with shiny appearance is seen.	-Marginal or partial resectioning with or without reconstruction is recommended.
6.	Fibrous dysplasia of bone 2 types: i. Mono-osteotic type.	-Mostly seen in children and involves mainly maxillary jaw. -Asymptomatic slow growing lesion and involving only one bone. Sometimes facial asymmetry may be seen.	-Initially in the early stage unilocular or multilocular radiolucent lesion is seen. -Then multilocular, mixed radio opaque and radiolucent lesion involving the surrounding structure -mixed stage "mottled appearance".	- Proliferating fibroblast in a compact stroma of interlacing collagen fibres and irregular bony trabeculae is seen. Shows "Chinese letter like" appearance.	-Enucleation and/or curettage is done, if needed with or without reconstruction.
	ii. Poly-osteotic type.	-Asymptomatic slow growing lesion and involving more than one bone. Café-au-lait pigmentation on skin is seen.	-Finally at the mature stage, a dense radioopaque lesion is seen-shows "peau de orange" or "ground glass" or "orange peel" appearance.		

ORAL MALIGNANCIES

Definitions

1. Benign: A Tumor is said to be benign when its microscopic and growth characteristics will remain localized, cannot spread to other sites

and is thus generally amenable to local surgical removal and better survival of the patient.

2. Malignant: A Tumor is said to be malignant when the adjacent structures are involved and spread to distal site (metastasis) to finally cause death.

3. Precancerous lesion: It is a morphologically altered tissue in which cancer is more likely to occur than in apparently normal counterpart.

Examples: Erythroplakia, leukoplakia, palatal changes seen in reverse smoking.

4. Precancerous condition: It is a generalized state associated with a significantly increased risk for cancer.

Examples: Oral submucous fibrosis, syphilis and oral hairy leukoplakia.

CLASSIFICATION OF ORAL MALIGNANCIES

1. Odontogenic hard tissue tumors:
 - i. Odontogenic carcinomas:
 - Malignant ameloblastoma.
 - Primary intra osseous carcinoma
 - Malignant variant of other odontogenic epithelial tumors like malignant CEOT.
 - Malignant neoplasm arising from odontogenic cysts.
 - ii. Odontogenic sarcomas:
 - Ameloblastic fibrosarcoma.
 - Ameloblastic fibro odontosarcoma.
2. Non odontogenic soft tissue tumors:
 - i. Malignant epithelial neoplasm:
 - Carcinoma in sites
 - Squamous cell carcinoma
 - Basal cell carcinoma
 - Verrucous carcinoma
 - Melanoma
 - Metastatic carcinoma.
 - ii. Malignant connective tissue neoplasm
 - Fibrosarcoma
 - Malignant fibrous histiocytoma.
 - Liposarcoma
 - Rhabdomyosarcoma
 - Leiomyosarcoma
 - Lymphomas
 - Kaposi's sarcoma.
3. Neoplastic lesions of jaw and facial bone.
 - i. Malignant neoplasm
 - Orthosarcoma
 - Chondrosarcoma

- Giant cell tumor
- Metastatic tumor

ETIOLOGY OF ORAL MALIGNANCIES

Factors that promote development of cancer are:

1. Increasing age.
2. Immune deficiency
3. U.V Radiations
4. Tobacco and alcohol
5. Diet and nutritional deficiency
6. Fungal infection
7. Viruses
8. Oro dental irritations.

The 6 'S' of cancer etiology:

1. Syphilis
2. Spices
3. Smoking
4. Sepsis
5. Sharp tooth
6. Spirit

GENERAL FEATURES OF ORAL MALIGNANCIES

- They are initially asymptomatic and are mostly identified after development of symptoms and after progression of disease.
- Patient discomfort is the most common symptom.
- Lesion may appear as a diffuse swelling or ulcerated mass or swelling.
- Patient complains of dysphasia, odynophagia (pain in tongue while swallowing), otalgia, limited movement of mandible and oral bleeding.
- Tissue change that may occur includes red, white or mixed red and white lesions.
- Lesion may be flat or elevated, ulcerated or non ulcerated, palpable or non palpable.
- Loss of function involving tongue may affect speech, swallowing and diet.
- Unilateral and bilateral lymph nodes become enlarged, firm to hard in texture, non tender unless associated with infection

or an inflammatory response present following biopsy and fixed to adjacent tissues.

GRADING AND STAGING OF ORAL MALIGNANCIES

Broader's Grading of Squamous Cell Carcinoma

Grade I — Well differentiated, less than 25 percent anaplastic cells.

Grade II — Moderately differentiated 25 - 50 percent anaplastic cells.

Grade III — Moderately differentiated, 50 - 75 percent anaplastic cells.

Grade IV — Poorly differentiated, more than 75 percent anaplastic cells.

TNM — Staging of Oral Malignancies

T — Is determined by size of primary tumor.

N — Presence of lymph node involvement.

M — Distant metastasis.

Sl.No.	T	N	M	Staging
1.	T _{1s} - Carcinoma in situ	1. N ₀ - No node involvement.	1. M ₀ - No node metastasis.	Stage 1 – T ₁ N ₀ M ₀
2.	T ₁ - tumor less than 2 cm.	2. N ₁ - Single ipsilateral less than 3 cm.	2. M ₁ - metasis present.	Stage 2 – T ₂ N ₀ M ₀
3.	T ₂ - tumor more than 2 cm less than 4 cm.	3. N ₂ - a. Single ipsilateral more than 3 cm and less than 6 cm.		Stage 3 – T ₃ N ₀ M ₀ or Any T N ₁ M ₀
4.	T ₃ - tumor more than 4 cm.	b. Multiple ipsilateral less than 6 cm.		Stage 4 – T ₄ any N M ₀
5.	T ₄ - tumor more than 4 cm with invasion of adjacent structure, i.e. through the cortical bone deep into the muscle, tongue, sinus and skin.	c. Bilateral or contralateral less than 6 cm. 4. N ₃ - a. ipsilateral more than 6 cm. b. Bilateral more than 6 cm.		any T N ₂ /N ₃ M ₀ or any T any N M ₁

DIAGNOSIS OF ORAL MALIGNANCIES

Diagnosis of oral malignancies is done by the combination of following methods:

1. Proper clinical examination
2. Toluidine blue staining and Acridine binding method.
3. Histopathological diagnosis by biopsy procedures
4. Imaging techniques.

TREATMENT OF ORAL MALIGNANCIES

The choice of treatment depends on the following factors:

1. Site of lesion.
2. Lymph node status.
3. Presence of bone and adjacent structures involvement
4. Ability to achieve adequate surgical margin.
5. Ability to preserve speech and swallowing functions
6. Physical and mental status of the patient
7. Through assessment of potential complications of the treatment made.
8. Experience of surgeon and radiotherapist.
9. Personal preference and co-operation of patient.

The treatment choices are:

1. Surgical treatment (resection with or without reconstruction)

2. Radiation therapy
 - Brachytherapy
 - External beam therapy
 - Radiation using heavy charged particles.
3. Chemotherapy
4. Immunotherapy
5. Cryosurgery.

Various chemotherapeutic agents are (Antineoplastic drugs):

1. Alkylating agents
 - i. Nitrogen mustards—cyclophosphamide, chlorambucil
 - ii. Nitrosureas—Tumustine, streptozotocin
2. Antimetabolites
 - i. Folate antagonist—methotrexate
 - ii. Purine analogue—6-mercaptopurine, thioguanine
 - iii. Pyrimidine analogs—5-fluorouracil
3. Antibiotics

Dactinomycin, mitomycin, plicamycin, rubidomycin
4. Plant products
 - i. Vinca alkaloids—vincristin, vinblastin
 - ii. Taxoids—paclitaxel
 - iii. Epipodophyllotoxins—etoposide
5. Hormones
 - i. Corticosteroids—prednisone
 - ii. Androgens—testosterone

- iii. Estrogens—diethylstilbesterol
- iv. Antiestrogen—tamoxifen
- v. Progestins—hydroxyl progesterone
- vi. RH analogue—leuprolide
- vii. Adrenal suppressant—amino glutethimide
- viii. Antiandrogens—flutamide, nilutamide
6. Radioactive isotopes-
I¹³¹, Au¹⁹⁸, P³²
7. Topoisomerase inhibitors-
topotecan, irinotecan
8. Miscellaneous
Hydroxyureas, interferons, asparaginase.

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Salivary Gland and Its Disorders

16

Salivary glands are glands that produce saliva. There is three pair of major salivary glands — parotid gland, submandibular gland and sublingual gland; and few groups of minor salivary glands. These glands are stimulated by reflex action, which can be initiated by the taste, sight or thought of food to secrete saliva.

ANATOMY OF MAJOR SALIVARY GLAND

Parotid Gland

It is the largest salivary gland and is placed at the side of the face just below and in front of the external ear. The gland has two parts - superficial and deep. The main part of the gland is superficial, which is flattened and quadrilateral. It lies between the ramus of mandible, mastoid process, temporal bone and sternocleidomastoid muscle. It is wide superiorly and reaches up to the zygomatic arch while inferiorly it tapers near the angle of mandible. The gland is enclosed in a capsule which is continuous with the deep cervical fascia.

The parotid duct which is known as the Stenson's duct starts at the anterior border of the gland and opens in the vestibule of mouth opposite the crown of upper second molar tooth. It is 7 cm long and while leaving the parotid gland it lies over the masseter, pierces buccinator,

runs for a short distance obliquely forward between the buccinator and the mucous membrane of the mouth. Duct has a thick wall which narrows at the opening into the mouth.

Submandibular Gland

It is a walnut- sized mixed salivary gland (which secretes both mucous and serous fluid) is placed in the submandibular triangle. It reaches anteriorly to the anterior belly of digastric and posteriorly to the stylomandibular ligament. The gland extends superiorly under the inferior border of mandible. The upper part of superficial surface of the gland lies partly against the submandibular depression on the inner surface of mandible and partly on the medial pterygoid muscle. The lower part is covered by skin, superficial fascia, platysma and deep cervical fascia.

The submandibular duct is known as the Wharton's duct, starts at the deep surface of the gland and runs between the sublingual gland and genioglossus. It opens on a small papilla at the side of lingual frenum.

Sublingual Gland

It is a paired salivary gland which is situated under the mucous membrane of the floor of the mouth, beneath the tongue. It is narrow and

almond shaped. The alveoli of sublingual gland secrete mucus. It is bounded inferiorly by the mylogoid, posteriorly by submandibular gland, laterally by mandible and medially by the genioglossus from which it is separated by the lingual nerve and submandibular duct. The sublingual duct is called as the Bartholin's duct and opens in the floor of the mouth. Minor sublingual duct is called as duct of Rivinus.

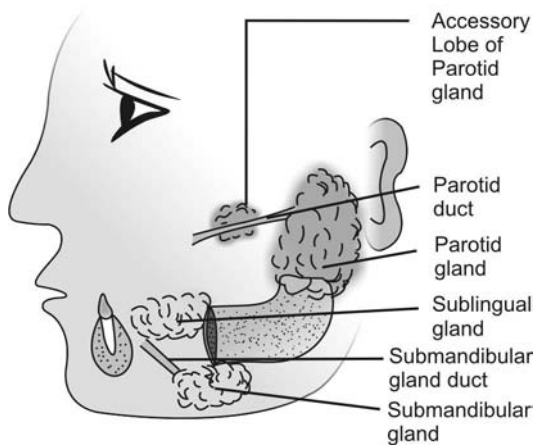


Fig. 16.1: Location and position of major salivary glands and their ducts

FUNCTIONS OF SALIVA (SECRETION OF SALIVARY GLAND)

1. **Digestive function:** Helps in formation of food bolus and action of enzyme amylase and lipase
2. **Protective function:**
 - Lubricating and keeps the oral tissues moist.
 - Cleansing and buffering action which protects teeth from dental caries.
 - Dilates hot or irritating substances and thus prevents injury to mucus membrane.
 - Antibacterial properties.
 - Accelerates wound healing by the presence of nerve growth factor and epidermal growth factor.
3. **Excretory function:** Many drugs as well as alcohol are excreted into saliva.

4. **Water balance:** Maintains appropriate level of hydration
5. **Hormonal function:** Epidermal growth factor and other polypeptide hormones are found in the saliva.

DIAGNOSIS OF SALIVARY GLAND DISORDERS

The diagnosis of salivary gland disorder is done by the combination of following methods.

1. Proper case history and clinical evaluation
2. Study of flow rate from major salivary gland
3. Salivary gland scanning (scintigraphy)
The salivary gland takes up compound of periodic group VII elements such as iodine, bromine and technetium and thus is used for studying the glandular parenchyma.
4. Ultrasonography
5. Computerized tomography
6. Arteriography to study the vasculature tumor.
7. Histopathological study by biopsy procedure
8. Magnetic resonance imaging
9. Laboratory analysis of the content of the saliva
10. Sialography

It is a specialized radiographic technique used to diagnose various salivary gland disorders.

Indications for sialography-

- i. To study normal anatomy and physiology of gland.
- ii. To detect any obstructions and shrinkage of duct.
- iii. To detect chronic inflammatory condition of the gland
- iv. To detect stones and tumor or foreign body of gland.
- v. To detect fistula of gland
- vi. Selection of biopsy site.

Contraindications for sialography

- a. Acute infections of gland
- b. Patients with known sensitivity to iodine containing compounds.
- c. Patients anticipated for thyroid function test.

Technique for Sialography

It is a close system cyanographic technique where a lacrimal probe is used to dilate the sphincter at the ductal orifice prior to passing a canula connected by extension tubing to a syringe like ethiodol or non-lipid soluble like sinography contrast solution is slowly infused until the patient feels discomfort, usually 0.2-1.5 ml depending on the gland to be studied. Fluoroscopic monitory or a series of conventional radiographs are taken. The syringe containing the contrast agent is taped to the patient's chest or shoulder, outside the area of interest. Normally the image of the ductal system appears as tree limbs with no area of gland devoid of ducts. The gland is allowed to empty for five minutes. If imaging suggests contrast retention, a sialogouge solution such as lemon juice or 2 percent citric acid may be administered to augment the emptying phase by stimulating secretion.

Significance of Sialography

1. It is contraindicated in acute sialadenitis
2. In chronic sialadenitis, the sac like acinis and ducts are mildly dilated.
3. In sialodensis, the gland appears enlarged
4. The early cystic lesions are visualized



Fig. 16.2: Sialographic view of parotid gland and its ducts

5. In sialolithiasis, a cigar shaped or oval shaped radio opacity is seen.
6. In benign tumor of gland, a "ball in hand" appearance is seen.
7. In Sjögren's syndrome 'fruit laden branchless tree' or 'cherry blossom' appearance is seen.

SURGICAL TREATMENT OF SALIVARY GLAND DISORDERS

- I. Transoral sialolithotomy of submandibular gland (Figs 16.3 and 16.4):
 - a. It is a process done under local anesthesia and in sitting position.
 - b. Preoperative radiograph and palpation of the gland is done to locate the exact site of stone and duct.
 - c. The tongue is tied and retracted to prevent it from falling back
 - d. A suture is placed behind the stone to prevent to the slipping of stone more posteriorly.
 - e. Push the gland extraorally to make the stone palpable from intraoral site.
 - f. Make a longitudinal incision over the stone with proper care to pressure the sublingual gland and lingual nerve.
 - g. Milking of duct is done to retrieve the stone by a small forceps or in case of larger stones; it is crushed and retrieved in pieces.
 - h. Proper irrigation of the area is done followed by suturing only at the level of the mucosa (duct should not be sutured otherwise compression of duct occurs and a fistula results).
- II. Transoral sialolithotomy of parotid gland (Fig. 16.5):
 1. Access to parotid gland stone is difficult than submandibular gland stone due to the anatomic peculiarity of the parotid gland.
 2. Direct incision over the stone is possible only if the stone is present anterior to massetric muscle but in most of the cases

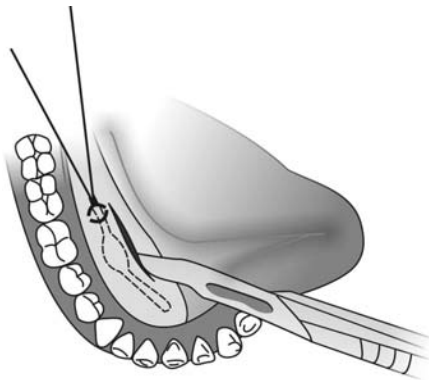


Fig. 16.3: Transoral sialolithotomy of submandibular gland

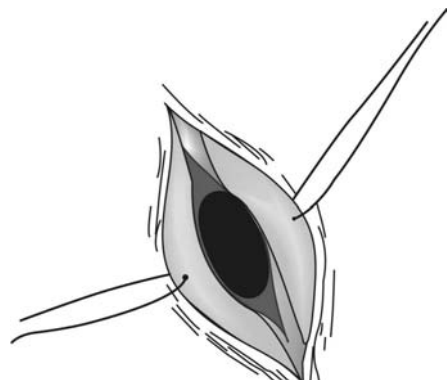


Fig. 16.4: Submandibular gland duct opened and stone located

the stone is present posterior to masseteric muscle, so it is difficult to reach it. In this case a semi lunar incision running from above downward in front of caruncle is made. The caruncle, mucosal flap, and duct are retracted medially and the cheek is retracted laterally.

3. Now direct access is got to the duct. A blunt longitudinal dissection is done lateral to the duct and the stone is retrieved.
4. Irrigation and suturing is done.

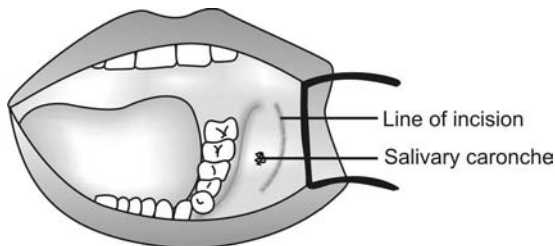


Fig. 16.5: Transoral sialolithotomy of parotid gland

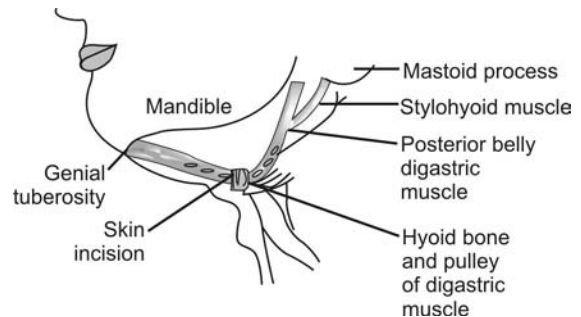


Fig. 16.6: Removal of submandibular gland

IV. Removal of parotid gland (Fig. 16.7):
The removal of parotid gland is not considered to be within the preview of the oral

III. Removal of submandibular gland (Fig. 16.6):

1. In this process a 5 cm long extraoral incision is made along the course of the digastric muscle which is determined by a curved line joining the mastoid eminence, the lateral surface of hyoid bone and the genial tubercle.
2. With proper care to ligate and cut the facial artery and protect the facial nerve

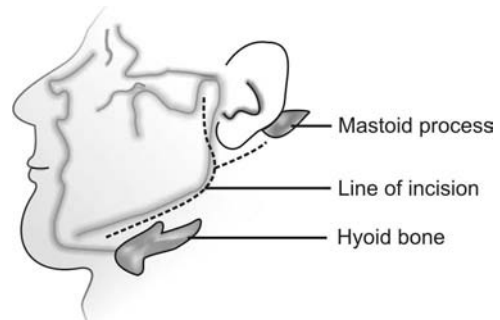


Fig. 16.7: Removal of parotid gland

surgeon, but with special training an oral surgeon can be assisting during the procedure. For this procedure an incision is made from the superior attachment of the pinna downward, turn anteriorly at the angle of the mandible, and stops at the hyoid bone. A second incision made posterior to pinna, joins the first of the inferior margin of the pinna. With proper care to protect the facial nerve, the gland is made free and removed, and postoperative care is taken.

CLASSIFICATION OF SALIVARY GLAND DISORDERS

- I. Developmental
- II. Inflammation (sialadenitis):
 - i. Acute or chronic bacterial sialadenitis
 - ii. Viral sialadenitis
- III. Obstructive and traumatic lesion
 - i. Sialolithiasis
 - ii. Mucocele and Ranula
- IV. Functional disorders
 - i. Xerostomia
 - ii. Ptyalism (sialorrhea)
- V. Neoplastic lesions:
 - i. Benign lesions
 - ii. Malignant lesions
- VI. Autoimmune conditions
 - i. Sjögren's syndrome

STUDY OF SALIVARY GLAND DISORDERS

I. Bacterial Sialadenitis

These are inflammatory condition of the salivary gland caused due to bacterial invasion. They are of two types:-

1. Acute Bacterial Sialadenitis:

Etiopathogenesis:-

Bacteria like *Staphylococcus aureus*, *Streptococcus aureus*, *Streptococcus viridans* and *Actinomyces* species invade the salivary gland especially under the following conditions.

- Decreased salivary flow
- Deliberated health of patient

- Increase use of tranquilizers and TCAs
- Poor oral hygiene

Clinical Features

- i. Mostly unilateral involvement of gland
- ii. Patient complains of pain in the jaw which worsens while eating and speaking
- iii. Tender and enlarged gland
- iv. Overlying skin is red and warm
- v. Fever, leucocytosis, nausea and fatigue may be there.

Treatment

- i. The condition is treated aggressively with antibiotics before the features worsen.
- ii. Adequate hydration and electrolyte balance is maintained with IV fluids.
- iii. Salivation is stimulated by sucking of sour, hard candy.
- iv. In severe conditions surgical drainage of gland is considered.

2. Chronic bacterial sialadenitis:

Etiopathogenesis:-

Bacteria's like *Streptococcus viridans*, *E. Coli*, *Proteus*, pneumococci invade the salivary gland especially under the following conditions:

- i. Ductal obstruction
- ii. Sjögren's syndrome
- iii. Predisposing viral infections
- iv. Allergy
- v. Idiopathic

Clinical Features

- i. It is condition where recurrent parotitis occurs with unilateral jaw swelling and patient shows history of similar recurrence.
- ii. Mild symptoms of pain, fever is there with purulent material which can be milked from Stenons duct's orifice.

Treatment

- i. Conservative measures of hydration massage and use of sialogogues and antibiotics are mostly enough.
- ii. Rarely surgical drainage may be needed.

II. Sialolithiasis

It is a condition where there is inflammation of a sialolith. A sialolith is calcified organic crystalline structure composed of layers of organic matter covered with concentric shells of calcified matter. This sialolith develop in the parenchyma or ducts of the major or minor salivary glands.

Etiopathogenesis

Sialolith formation occurs due to a combination of several factors. These are:

- Inflammations of the gland
- Local irritants
- Drugs that causes stasis leading to build up of an organic nidus that finally calcifies.

Most of the sialolith are formed in the submandibular gland or its duct as:

- Wharton's duct contains sharp curves likely to trap mucus plug or cellular debris.
- Calcium levels are more in saliva from submandibular gland.
- The position of the submandibular gland increases the chance for stasis.

Clinical Features

- Painful, intermittent swelling in the area of a major salivary gland, which worsens during eating and resolves after meals. This pain is due to accumulation of saliva behind the stone.
- The stasis of saliva may lead to infection, inflammation, fibrosis, or atrophy of the glandular parenchyma.
- In chronic cases sinus tracts, fistulas and ulceration over the stone may be formed.
- In case of sialolith present in the Stenson's or Wharton's duct, it may be palpable. But in minor salivary glands they are rarely painful and may even be asymptomatic.

Diagnosis

Best done by combination of clinical evaluation, radiographs and sialography along with ultrasonography (Fig. 16.8).



Fig. 16.8: Radiographic view of submandibular gland stone

Treatment

- Acute infection due to stasis is treated by antibiotics.
- In case of stone in the distal portion of the duct, it is removed manually.
- In other conditions transoral sialolithotomy is done as described earlier.

III. Mucoccele and Ranula

It is a cystic swelling of the salivary gland caused due to extravasations or retention of the saliva. A detailed description of the condition has been done in the chapter of the 'cysts of the oral cavity' (Fig. 16.9).

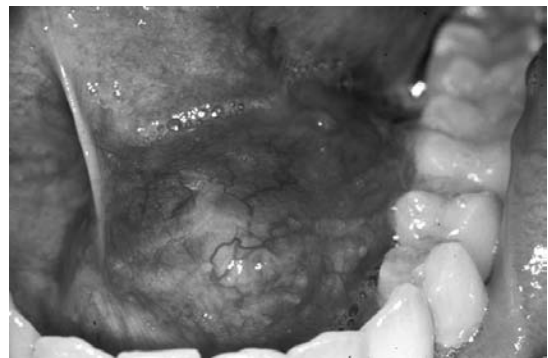


Fig. 16.9: Clinical view of ranula of submandibular gland (For color version see plate 4)

IV. Neoplastic Lesions (tumors) of the Salivary Gland

Classification of salivary gland tumors :

1. Benign tumor:

- i. Pleomorphic adenoma
- ii. Warthin's tumor
- iii. Basal cell adenoma.
- iv. Myoepithelioma

v. Canalicular adenoma.

vi. Ductal papilloma.

2. Malignant tumors:

- i. Mucoepidermoid carcinoma
- ii. Adenoid cystic carcinoma (ACC)
- iii. Malignant pleomorphic adenocarcinoma
- iv. Serous cell adenocarcinoma
- v. Acinar cell tumor
- vi. Undifferentiated carcinoma.

Sl.No.	Name of tumor	Etiopathogens	Clinical features	Histological features	Treatment
1.	Pleomorphic adenoma	The mucoepidermoid cells, basket cells or intercalated duct cells shows metaplasia and leads to various types of tissues	- Mostly affects females in 4th to 6th decade of life. - Parotid gland is mostly affected. - Starts as small swelling and grows to form firm, palpable nodular swelling. - No other features are seen.	- Clear well defined capsule with a variety of cells are seen.	- Complete removal of the involved gland with the overlying mucosa. - Prolonged radiotherapy can also be done.
2.	Warthin's tumor	Arises from the proliferation of mass formed by entrapment of salivary gland tissues within the intra parotid and para parotid lymph nodes during embryogenesis.	- Mostly affects adult male. - Parotid gland is affected. - it appears as painless, small nodule like swelling in the centre with which is firm and rough like in consistency.	- There is a cystic formation having eosinophilic coagulation in the centre with papillary projections formed by two epithelial layers and lymphatic tissues.	- Surgical removal of the gland
3.	Mucoepidermoid carcinoma	It contains both mucus secreting and epidermoid cells.	- seen in children and adults. - Mostly affects parotid gland. - can be low grade as well as high grade. - Low grade is a slowly enlarging painless mass reversibility, mucocele. - High grade is aggressive, painful mass which is fixed and may be ulcerated and even spreads to adjacent tissues.	- It shows mucous cells, epidermoid cells, and intermediate cells.	- Surgical removal of the gland followed by radiotherapy.
4.	Adenoid cystic carcinoma	-----	- Mostly seen in old age. - Parotid gland is mostly affected. - Pain with localized discomfort and ulceration is seen. - Facial nerve paralysis is also seen.	- 'Honey comb' or 'Swiss Cheese' appearance is seen formed by basal cells which surround cystic spaces having mucoid cells.	- Surgical removal of the gland followed by radiotherapy.

V. Sjögren's Syndrome

It is an autoimmune disorder of exocrine glands that may be associated with other connective tissue disease, neuropathy and lympho proliferative disorders.

Types

- Primary Sjögren's syndrome — Affects the exocrine glands only (lachrymal and salivary gland)
- Secondary Sjögren's syndrome — consists of salivary gland involvement with an associated connective tissue disease like rheumatoid arthritis, SLE, Scleroderma and polymyositis.

Clinical Features

1. Mostly affects middle aged and elderly females.
2. Patient complains of dry eyes with a feeling of dirt or other foreign body in the eye.
3. Corneal ulceration, conjunctivitis, dryness of larynx, pharynx and nose, lack of secretion in the upper respiratory tract is seen.
4. Xerostomia, enlargement of submandibular salivary gland and other secondary oral diseases like candidiasis or increase dental caries incidence is there.
5. Renal involvement, polyneuropathy, vasculitis and pneumonitis are also seen.

Diagnosis

The diagnosis is done by proper clinical evaluation along with the following investigations.

1. *Schirmer's test*: Here, filter paper is placed in the lower conjunctival sac and the wetting of the paper is examined. In a normal patient 15 mm of filter paper is wet in 5 minutes, whereas in a Sjögren's patient less than 5 mm of filter paper will be wet in 5 minutes.
2. *BUT (Break up time test)*: Here, a slit lamp is placed in front of the patient and the time interval between complete blink and the appearance of a dry spot on cornea is noted.

3. *Rose Bengal dye test*: It is used to detect the damaged and denuded areas on the cornea.
4. *Salivary flow rate examination*: Secretion of 0.5 ml saliva or less in a minute is seen in Sjögren's patient.
5. Salivary gland biopsy is done for histopathological examination.
6. Sequential scitigraphy
7. Radiographic examination
8. Sialography technique.

Treatment

Symptomatic treatment with care towards eye disorders and connective tissue disorders is done.

COMPLICATIONS OF SALIVARY GLAND SURGERY

1. In case of intraoral approach:
 - i. Anesthesia and paresthesia of the area (face).
 - ii. Damage to the salivary gland duct (Stenson's and Wharton's duct)
2. In case of extraoral approach:-
 - Frey's syndrome (auriculotemporal syndrome)
 - Facial palsy due to damage to facial nerve.
 - Salivary fistula formation.

FURTHER READING

1. Archer WH — Oral and maxillofacial surgery, 5th ed, Vol. 2.
2. Daniel M Laskin — Oral and maxillofacial surgery, The biomedical and clinical basis for surgical practice, Vol. 2.
3. Greenberg and Glick — Burket's oral medicine, diagnosis and treatment, 10th ed.
4. Gustav O Kruger — Textbook of oral and maxillofacial surgery, 6th ed.
5. Omar Abubaker, Keneth Benson — Oral and maxillofacial surgery secrets, 2nd ed.
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8. Stranding — Gray's anatomy, 39th ed.

Temporomandibular Joint Disorders

17

APPLIED ANATOMY AND PHYSIOLOGY OF TMJ

Temporomandibular joint is a diarthrodial synovial joint present at both sides of head and is composed of articulating surface, articulating disc and ligaments. It is classified as ginglymodiarthroidal joint, namely a joint that is capable of hinge type movement (ginglimos) and gliding movement, with the bony component enclosed and connected by a fibrous capsule.

i. Articulating Surface

The upper component of the articulating surface is formed by the articular eminence and anterior part of glenoid fossa. The lower component is formed by the condylar head of mandible.

ii. Articular Disc

It is biconcave fibrous disc with thick anterior and posterior bands and thin intermediate zone. It divides the joint space into upper and lower component. It acts as a shock absorber in the TMJ.

iii. Ligaments

TMJ ligaments are four in number. They are

- a. *Fibrous capsule (capsular ligament)*: It is fibroelastic sac encompassing the entire TMJ. The inner surface of the capsule is smooth

and shiny and it is covered by a synovial membrane lining. It acts to resist any medial, lateral or inferior forces that tend to separate or dislocate the articular surface. Also, it encompasses the joint, thus retaining the synovial fluid.

- b. *Collateral ligament (distal ligament)*: This ligament resists the movement of the disc away from the condyle, as it slides anteriorly and posteriorly.
- c. *Temporoamandibular ligament (lateral ligament)*: This ligament gives strength to the lateral aspect of the fibrous capsule and resists excessive dropping of the condyle and therefore acts to limit the extent of mouth opening.
- d. *Sphenomandibular ligament*: This is an accessory ligament which does not have any significant effect on mandibular movement.
- e. *Stylomandibular ligament*: This is an accessory ligament which limits the excessive protrusive movements of mandible.
- f. *Mandibular malleolar ligament*: This is an accessory ligament which does not have any significant effect on mandible movement.

NERVE AND BLOOD SUPPLY OF THE TMJ

Nerve Supply

It is innervated by the branches of auriculo-temporal nerve, massetric nerve, and the

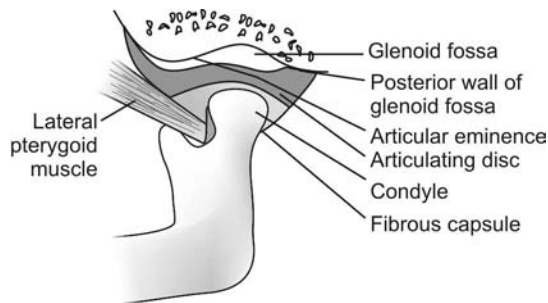


Fig. 17.1: Anatomy of temporomandibular joint

posterior deep temporal nerve, which are branches of the Mandibular portion of the trigeminal nerve.

Vascular Supply

It comes from the branches of the superficial temporal arteries, deep auricular arteries, anterior tympanic arteries and ascending pharyngeal arteries.

Development of the TMJ

It develops in 10th and 12th intrauterine week. At 10th intrauterine week mesenchyme appears in between the condyle and temporal bone. At 12th intrauterine week the articular disc with innervations appears.

Functional Movements of TMJ

The movements of the TMJ can be divided into two kinds:

- i. Involving articulating surface and disc.
- ii. Involving articulating disc and condyle.

The movements are:

- a. Elevation (Jaw closing)
- b. Depression
- c. Protrusion
- d. Retrusion
- e. Lateral excursive movements.

MUSCLES RELATED TO THE TEMPOROMANDIBULAR JOINT

Sl.No.	Features	Temporalis muscle	Masseter muscle	Medial pterygoid muscle	Lateral pterygoid muscle
1.	Origin	Temporal lines	Zygomatic arch	Pterygoid process of sphenoid.	Pterygoid process of sphenoid.
2.	Insertion	Coronoid process	Lateral surface of mandibular ramus and angle.	Medial aspect of mandibular angle.	Slightly anterior to mandibular condyle.
3.	Nerve supply	Trigeminal nerve, mandibular branch (divided branch)	Trigeminal nerve, mandibular branch (divided branch)	Trigeminal nerve, mandibular branch (main trunk)	Trigeminal nerve, mandibular branch (divided branch)
4.	Action	Elevates mandible for biting and chewing; retracts mandible.	Elevates mandible; produces forceful bite and some lateral excursion.	Elevates mandible; produces lateral excursion.	Protracts mandible; produces lateral excursion.
5.	Clinically pain refers to	Temple, maxillary teeth, TMJ.	Mandible, maxillary molar, TMJ, ear.	TMJ, retromandibular area, tongue.	TMJ
6.	Clinical effect	Restriction of mandibular opening, ipsilateral deviation of mandible, deviation of interocclusal space.	Same as temporalis.	Restriction of mandibular movements, contralateral deviation of mandible.	Contralateral deviation of the mandible, protrusion of condyle, acute malocclusion.

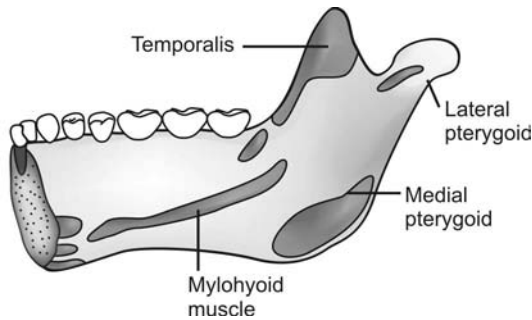


Fig. 17.2: Muscles of mastication

CLASSIFICATION OF TMJ DISORDERS (BY WELDON BELL)

I. Intracapsular

- A. Degenerative joint diseases.
 1. Osteoarthritis.
- B. Inflammatory
 1. Rheumatoid arthritis (and other collagen disorders)
 2. Psoriatic arthritis
- C. Infection
 1. Gonorrhea
 2. Spread from contiguous sites
 3. Tuberculosis
 4. Syphilis
- D. Developmental
 1. Condylar hyperplasia
 2. Condylar hypoplasia
 3. Agenesis
- E. Traumatic
 1. Condylar fracture
 2. Ankylosis
 3. Dislocation
 4. Disc displacement
- F. Metabolic
 1. Gout
- G. Neoplasia
 1. Benign
 2. Malignant

H. Drug induced

1. Steroid

II. Extracapsular

1. Psychophysiologic (myofascial pain dysfunction syndrome -MPDS)
2. Iatrogenic
3. Traumatic
4. Those referred from local dental origin
5. Infection
6. Otologic
7. Neoplastic

DIAGNOSIS OF TEMPORO-MANDIBULAR JOINT DISORDERS

The diagnosis of TMJ disorders is done by the combination of following method:

1. Proper history taking
2. Clinical evaluation
 - i. Inspection of:
 - Dental examination
 - Occlusal examination
 - Mandibular movement.
 - ii. Palpation:
 - Muscle tenderness
 - Ear pain
 - Neurological examinations
 - iii. Auscultation
 - Clicking sound
 - Crepitus sound.
3. Radiological investigation:
 - i. Plain radiography
 - Transcranial view
 - Transpharyngeal view
 - Transorbital view
 - Reverse Towne's projection
 - Water's projection
 - ii. Tomography
 - provides a series of radiographs and depicts a greater portion of the joint.

iii. Arthrography:

Defects of the soft tissue derangement and disc joint can be determined by arthrography. Here, water soluble iodine containing contrast material is injected into the lower joint space and radiograph is taken to better visualize the area.

iv. Arthroscopy:-

Visualization and diagnosis of the arthrosis, inflammatory diseases-arthritis, remodeling, adhesion and perforation of the TMJ can be done by arthroscopy technique. Besides, synovial biopsies can also be done.

v. Magnetic resonance imaging (MRI)

Ionizing radiations are used to determine the TMJ disorders.

vi. Electromyography:-

Provides an objective means of monitoring changes in muscle activity and is helpful in diagnosing myofascial pains. It is an important component of bio feedback treatment for myofascial pain.

vii. Cinefluoroscopy-

Dynamic depiction of the soft tissue components of the joint are produced while in function by the help of relatively low level of radiations.

4. Laboratory investigation:-

Biochemical and serological tests are done to diagnose the infective and metabolic disorders of the TMJ.

SURGICAL APPROACHES TO THE TEMPOROMANDIBULAR JOINT

The surgical approaches to expose the temporomandibular joint area are:

1. Blair's Inverted hockey - stick Incision (inverted L): It commences from the temporal hairline and curving downwards to the anterior auricle (Fig. 17.3).
2. Dingman's and Moorman's Incision: This incision sections the minor fibrous

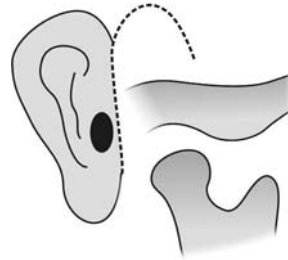


Fig. 17.3: Blair's incision

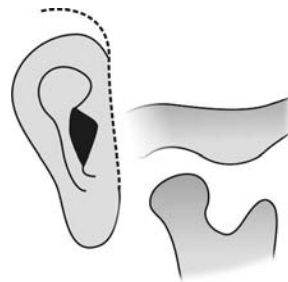


Fig. 17.4: Dingman's and Mooran's incision

- attachment of the lamina of tragus and superior aspect, reflecting this cartilage anteriorly and down over itself (Fig. 17.4).
3. Rowe's extended Blair's incision or Thoma's augmented incision: This incision is a modification of Blair's incision, which also resembles the original preauricular incision of Thoma (Fig. 17.5).

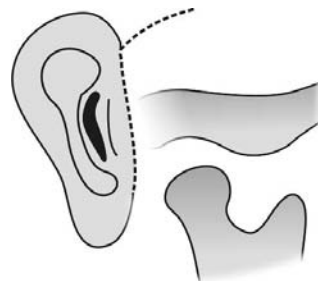


Fig. 17.5: Rowe's incision

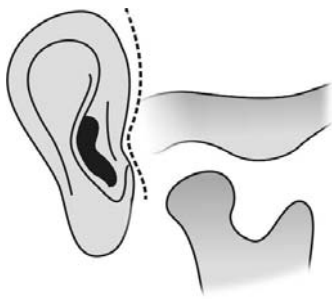


Fig. 17.6: Preauricular incision

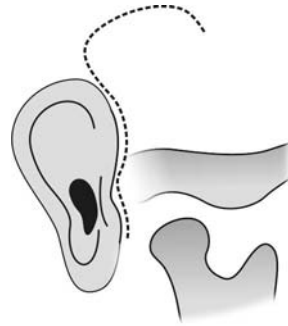


Fig. 17.8: Alkyat-Bramely incision

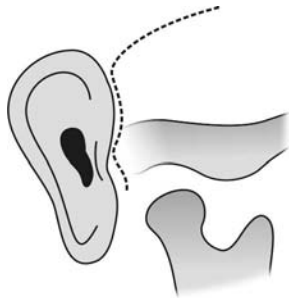


Fig. 17.7: Modified preauricular incision



Fig. 17.9: Risdon's incision

4. Preauricular incision and modified preauricular incision: This is the basic incision for temporomandibular joint ankylosis; This incision passes through avascular area and reduces operating time, postoperative edema, patient discomfort and gives good cosmetic results (Figs 17.6 and 17.7).
5. Alkyat- Bramely incision: This is a question mark shaped incision for maximum visual and mechanics access (Fig. 17.8).
6. Risdon's submandibular incision: The incision is given about 1cm below angle of the mandible. It extends forward parallel to the lower border and curves backward slightly behind the angle of the mandible. This approach provides poor access to the condylar head region (Fig. 17.9).
7. Hind's postramal incision: Excellent cosmetic procedure recommended by hind, for surgeries involving the condylar neck and ramus area (Fig. 17.10).
8. Popowich's and Crane's modification of Alkyat Bramely question mark incision: It is a modification Alkyat Bramely incision recommended by Popowich and Crane. The incision is slightly larger than the former incision. This incision provides excellent visual and mechanical access (Fig. 17.11).



Fig. 17.10: Hind's incision

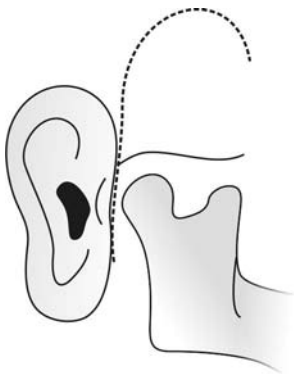


Fig. 17.11: Popcowich's incision

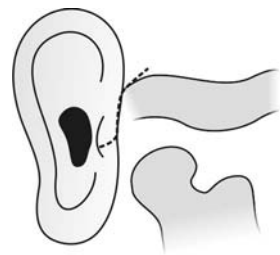


Fig. 17.12: Lampport's incision

9. **Lampport's Endaural Incision:** The incision begins above the zygomatic arch extends downwards and backwards between the tragus and the helix and then inward along the roof of the external auditory meatus for approximately 1 cm. This incision



Fig. 17.13: Post-auricular incision

provides excellent cosmetic result but limited access (Fig. 17.12).

10. **Post-auricular Incision:** The incision starts from the superior aspect and behind the external ear and extends to the tip of the mastoid process. This incision provides excellent cosmetic result but poor accessibility and visibility, stenosis, infection and paraesthesia of the external auditory canal and deformity of the auricles are also seen (Fig. 17.13).

SURGICAL TREATMENTS OF THE TEMPOROMANDIBULAR JOINT

1. **Eminectomy:** It is the removal of the eminence (Fig. 17.14).
2. **Condylectomy:** It is the total removal of the condyle (Fig. 17.15).
3. **Modified condylectomy:** It is a vertical ramus osteotomy, whereby the condylar process is detached from the mandibular ramus (Fig. 17.16).
4. **High condylectomy or condylar shaving:** It is limited bony reconditioning of the head of the condyle (Fig. 17.17).
5. **Plication:** It is folding or taking a tuck to reduce the size of disk (Figs 17.18 and 17.19).
6. **Gap arthroplasty and coronoidectomy:** It is a process of removing a section of bone to create a gap of 1 - 1.5 cm between the condylar head and eminence. The glenoid

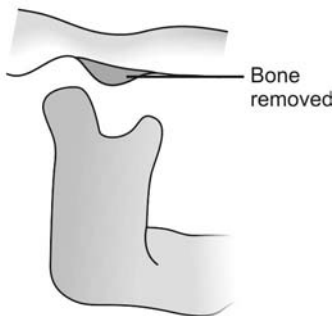


Fig. 17.14: Eminectomy

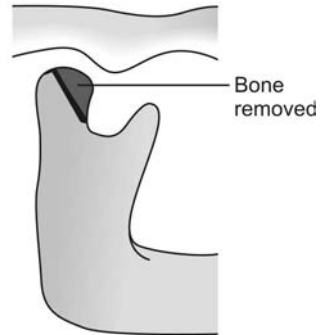


Fig. 17.17: Condylar shaving

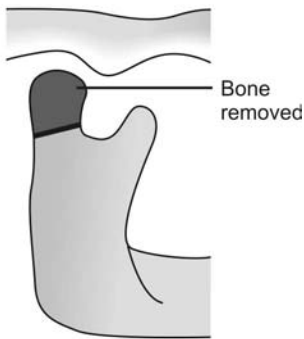


Fig. 17.15: Condylectomy



Fig. 17.18: Piece of ligament removed
(Plication – step 1)

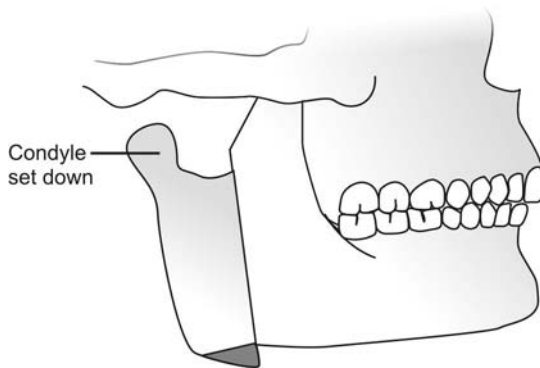


Fig. 17.16: Modified condylectomy



Fig. 17.19: Cut ends of the ligament sutured
(Plication – Step 2)

fossa may be recontoured if needed. Coronoid process is removed also (Fig. 17.20).

7. *Costochondral grafts:* These are graft materials, commonly used in VIIth Rib bone of about 1.5 cm or more to replace the

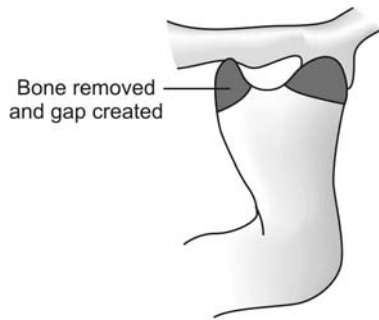


Fig. 17.20: Gap arthroplasty and coronoidectomy

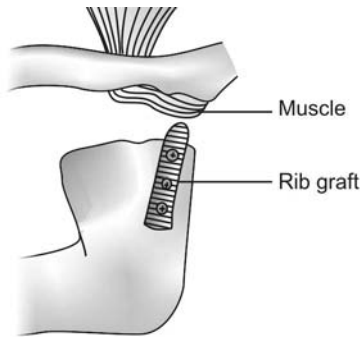


Fig. 17.21: Costochondral graft

resected condylar process. It is fixed to the ramus of mandible by stainless steel wiring or screws (Fig. 17.21).

8. **Arthrocentesis:** It is a process of needle puncture of the joint space; usually this is combined with lavage, which is irrigation of the joint.
9. **Arthroscopic surgery:** It is an operative procedure performed with fine instruments during telescopic penetration of a joint cavity for diagnosis and therapeutic reasons. The surgery is performed using a rigid endoscope (arthroscope) and is less invasive than arthrotomy.

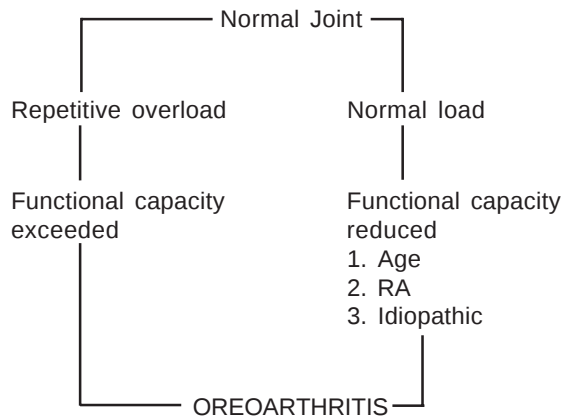
STUDY OF SOME COMMON TEMPOROMANDIBULAR JOINT DISORDERS

A. Intracapsular Disorders of TMJ

1. **Degenerative Joint Diseases (Osteoarthritis):**

It is a non-inflammatory degenerative disease affecting the articular surfaces, accompanied by remodeling of underlying bone.

Etiopathogenesis:



Clinical Features

The features are:

- Pain in the joint and muscular of mastication
- Spasm of muscle and limitation of mandibular movement.
- Joint noises, specially "crepitations"
- Females are more affected than males.
- Features gradually subside in 1 to 3 yrs and finally little or no disability is felt.

Radiographical Features

- Subchondral bony sclerosis or rough or woolly appearance is seen near the condylar region.
- Subarticular cysts and osteophytes are seen.
- There is gross destruction of the condyle.

Management

Non-Surgical

- Elimination of the cause and prolonged physiotherapy and myotherapy with occlusal splints is recommended. Systemic and local joint injections of corticosteroidal are administered along with NSAIDs to reduce pain.

Surgical

- Arthroplasty is done.
- High condyle shaving or condylectomy with or without TMJ prosthesis is done.

II. Inflammatory joint diseases (Rheumatoid arthritis):

It is a chronic deliberating autoimmune disease of the joint which spreads from the synovial membrane to the articulating surfaces.

Clinical Features

- TMJ is bilaterally affected.
- Dull deep pain, tenderness, stiffness and limited mandibular movement are seen, especially in early morning.
- Swelling of joint
- Joint sounds heard on auscultation.
- The features gradually subside as the lesion becomes more chronic.

Radiographic Features

- Destructive lesion with narrowing of joint space is seen.

Management

Non Surgical

Joint rest, soft diet, NSAIDs are recommended along with intra lesional corticosteroid injection in acute phase.

Surgical

- High condylectomy
- Arthroplasty
- Synovectomy (removal of synovial membrane which causes destruction of cartilage).

III. Infective Joint Diseases (Septic arthritis):

It is a condition commonly caused by blood borne or microorganisms, infection from adjacent sites like middle ear, maxillary molar and parotid gland.

Clinical Features

- Severe pain and swelling of joint.
- Inability to occlude teeth.
- Redness and inflammation of joint
- Large and tender cervical lymph nodes

Management

Joint rest with soft diet, NSAIDs and antibiotics are recommended. Surgical drainage of pus, if present.

IV. Developmental Joint Disorders

1. Condyle Hyperplasia

It is a unilateral or bilateral increase in the condyle growth due to local or systemic causes.

Features

- Limited mouth opening with occasion pain in the TMJ.
- Deviation of mandibular to the effected side with facial asymmetry.
- Treated by orthognathic surgery, without any permanent facial deformities, if done at an early age.
- Condylectomy or condyloplasty may also be done in some mild cases.

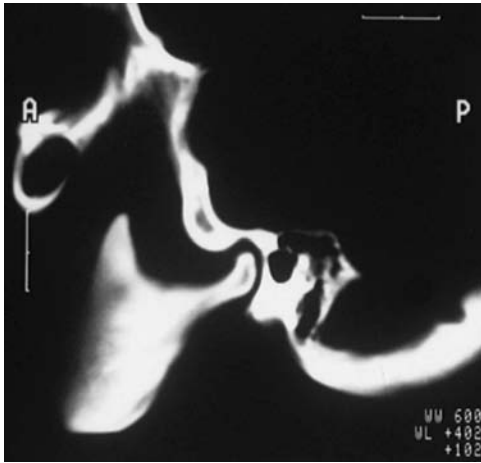


Fig. 17.22: 3D view of condylar hyperplasia

2. Condyle Hypoplasia

It is a unilateral or bilateral decrease in the condyle growth due to local or systemic causes (Fig. 17.22).

Features

- Limited mouth opening with occlusion deviation and facial deformity is seen
- Treated by graft surgeries with or without cosmetic improvement.

V. Traumatic Joint Diseases:

Ankylosis

It is an intracapsular condition where there is fusion of the bony surfaces of joint like condyle to glenoid fossa (Fig. 17.23).

Types of Ankylosis

I. Based on cause:

1. Fibrous ankylosis (Restricted mouth opening due to fibrous transformation of the articular disc.
2. Bony ankylosis (True fusion of bony parts of joint)

II. Based on location:

1. Unilateral — only one of the joints effected
2. Bilateral — both joints are affected.



Fig. 17.23: 3D view of ankylosis
(For color version see plate 4)

Etiology of Ankylosis of TMJ

1. *Trauma:* Intracapsular fracture in children and medically displaced condyle fracture.
2. *Infection:* Infections of the middle ear (otitis media) and septic arthritis.
3. *Inflammation:* Rheumatoid arthritis
4. *Surgery:* Postoperative complication following TMJ surgery.
5. *Congenital:* Rarely caused congenitally but may be due to congenital syphilis and intrauterine injuries.

Clinical Features

1. In unilateral ankylosis:

- a. Deviation of chin and mandibular on the affected side leading to facial asymmetry.
- b. Hypoplasia of mandible on the affected side.
- c. Well defined antegonial notch on the affected side.

- d. Flat and elongated unaffected side.
 - e. Limited mouth opening.
 - f. Class II malocclusion on affected side with posterior crossbite on the ipsilateral side.
2. In Bilateral ankylosis:
- a. 'Bird facies' deformity - symmetrical and micrognathic mandible.
 - b. Antegonid notch present bilaterally.
 - c. Class II molecular and crowding with anterior open bite and protrusive incisions.
 - d. Restricted mouth opening.

Investigation

It is done mainly by various radiographic techniques as described earlier (Fig. 17.24).

Management

Treatment objectives are:

1. To improve joint movement and function.
2. To restore vertical height of face.
3. To restore mandibular growth in case of ankylosis of TMJ in children below five years (corticochondral grafts are used).
4. To prevent recurrence.



Fig. 17.24: Radiographic view of ankylosis

Treatment of fibrous ankylosis: This is treated by applying brisement force under general anesthesia.

Treatment of bony ankylosis: Kaban, Pinnot and Fisher protocol for management of bony ankylosis of TMJ.

1. Early surgical intervention.
2. Aggressive resection of gap of at least 1-1.5 cm should be created (Interposition gap arthroplasty).
3. Ipsilateral coronoidectomy and temporalis myotomy.
4. Contralateral coronoidectomy and temporalis myotomy if mouth opening is less than 3-5 mm.
5. Lining of glenoid fossa region with temporalis fascia.
6. Reconstruction of the ramus with corticochondral graft.
7. Early mobilization and aggressive physiotherapy for at least six months.
8. Regular long term follow up.
9. To carry out cosmetic surgery at the late date when the growth of the patient is completed. (orthognathic surgery)

Complications

1. Operative

- i. Anesthetic complicated
- ii. Hemorrhage
- iii. Damage to external auditory meatus.
- iv. Damage to facial nerve.
- v. Damage to glenoid fossa.
- vi. Damage to auricular temporal nerve.
- vii. Damage to parotid gland.
- viii. Damage to teeth and jaws.

2. Postoperative

- i. Infection
- ii. Open bite
- iii. Recurrence; caused due to:
 - a. Inadequate gap created
 - b. Improper gap arthroplasty

- c. Fracture of costochondral graft
- d. Loosening of costochondral graft.
- e. Inadequate covering of glenoid fossa.
- f. Inadequate post operative physiotherapy

VI. Dislocation and Subluxation:

Dislocation or luxation occurs when the condyle moves into a position anterior to articular eminence from which it cannot be voluntarily reduced.

Subluxation or hyper mobility is a self limiting incomplete dislocation, which generally follows stretching of the capsule and ligaments.

Types of Dislocation

- I. Based on duration:
 - 1. Acute or luxation
 - 2. Long standing dislocation
 - 3. Chronic/habitual/recurrent luxation or Hypermobility or subluxation.
- II. Based on location:-
 - 1. Unilateral—only one joint involved
 - 2. Bilateral—both joints involved.
- III. Based on position:-
 - 1. Anterior dislocation
 - 2. Posterior dislocation
 - 3. Superior dislocation
 - 4. Medial dislocation
 - 5. Lateral dislocation

Predisposing factors for the cause of dislocation:

- 1. Thin ligament and capsule
- 2. Flattened articulating eminence
- 3. Shallow fossa
- 4. Parkinsonism
- 5. Rubber man (Ehlers-Danlos syndrome)

Etiology of dislocation of TMJ:

- 1. Intrinsic trauma:
 - Over extension injuries like-
 - i. Chewing
 - ii. Vomiting
 - iii. Wide biting
 - iv. Seizure disorders
 - v. Yawning

2. Extrinsic causes:

- i. Drug induced:
 - Phenothiazine (because of extrapyramidal action)
- ii. Trauma:
 - During intervention with GA and mouth gags
 - Endoscopy
 - Dental extractions

Clinical Features

- 1. On inspection:
 - i. Inability to close mouth, mouth held open and mandible deviated in unilateral cases and mandible protruded in bilateral cases.
 - ii. Excessive salivation and pain in TMJ.
- 2. On palpation: Preauricular depression on skin.

Investigations

This is mainly done by the clinical features along with radiograph evaluation (Fig. 17.25).



Fig. 17.25: Radiographic view of dislocation

Management

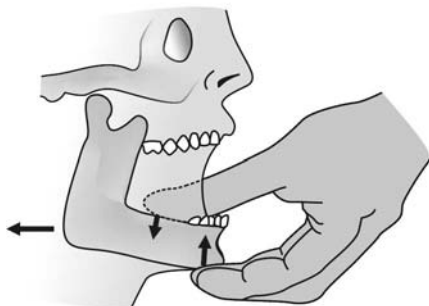
The choice of treatment depends on the type of dislocation and the features present.

- 1. In case of acute dislocation (luxation):-
 - Manual reduction as described by Hippocrates is the treatment of choice. In case of extreme muscle trismus or reduced mouth opening reduction is done under local anesthesia, general anesthesia or skeletal muscle relaxants.

In this procedure, the operator's thumbs are placed over the patient's molar area and other fingers are placed over anterior chin area. Force is applied on the mandible in the downward - posterior direction to disengage the condyle from its open locked position posterior to the articular eminence (Figs 17.26A and B).

2. In case of long standing dislocation the treatment done are:

- i. Manual reduction with or without jaw immobilization for a certain period to allow muscle and ligament adaptation by inter maxillary fixation.
- ii. In cases where manual reduction is not effective, reduction is done by pulling the mandible downward with the help of reduction hook placed in the sigmoid



(A)



(B)

Figs 17.26A and B: Bimanual reduction in luxation

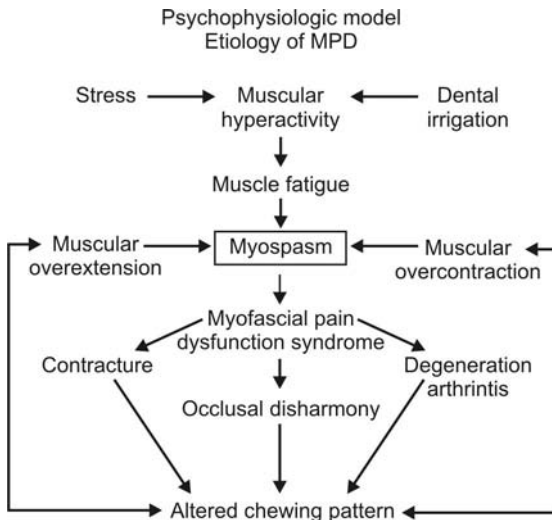
notch or wire fixed to lower border of mandible.

- iii. Osteotomy and condylectomy procedure are also practiced in cases where only reduction is not sufficient.
3. In case of chronic/habitual/recurrent luxation or hypermobility or subluxation the treatment done is:
 - i. Conservative approach by injecting sclerosing agents by arthroscopy technique into the TMJ to cause capsule shrinkage. These agents are 5 percent sodium psyllate or 5 percent intracaine in oil base.
 - ii. Manual reduction with or without jaw immobilization by intermaxillary fixation.
 - iii. Eminectomy for removal of obstructing articulating eminence in the path of condyle movement.
 - iv. Ligament and capsule plication for easy condyle movement.
 - v. Lateral pterygoid myotomy to limit the pressure exerted by lateral pterygoid muscle into the mandible.
 - vi. Restricting the movement of the condyle by creating a mechanical obstruction for condyle movement. This is done either by fracturing the articulating eminence and pushing it downward (Girard's method) or by fracturing the zygomatic arch and pushing it laterally and downward (Doutry's method).
 - vii. Placement of bone graft material onto the condyle or its path to limits its movement.

B. Extracapsular Disorders of TMJ

I. Myofunctional pain dysfunction syndrome (MPDS): Travell asserted that a vast majority of the patient with pain in the region of TMJ were suffering from a functional disorder involving on painful self perpetuating spasm of masticatory muscle. This condition of pain, dysfunction and muscle spasm of the masticatory muscles is called as MPDS.

Etiopathogenesis



Clinical Features

Four cardinal signs of MPDS by Laskin

1. Unilateral vague pain in the ear or preauricular area that commonly worsen on awakening.
2. Tenderness of one or more muscle of mastication on palpation.
3. Clicking or popping noise in the TMJ.
4. Limitation or deviation of the mandible on opening.

Laskin emphasized that the patient must also have the following negative characteristics:

1. Absence of clinical, radiographic or biological evidences of organic changes in the TMJ.
2. Lack of tenderness in TMJ area, on palpation via the external auditory meatus.

Management

MPDS management is done by proper managing the emotional as well as physical components. In the initial visit the following are done:

1. Patient is educated and advised to limit para functional habits like clenching and grinding of teeth during the day.

2. To apply warm and moist compression over the involved muscle, three times a day for 15-20 minutes.
3. Soft diet and restricted mouth opening.
4. NSAIDs are recommended

During the following visits the following are done:

1. Injecting local anesthesia into the muscle that are spasm.
2. To relieve pain ethyl chloride spray can be used and ultrasound can be used to relieve spasm.
3. Jaw exercises are recommended.
4. Drugs like antidepressants to reduce anxiety, tranquilizers for psychoses and sedatives and hypnotics for reducing pain can be given.
5. Occlusal adjustments and occlusal splints are recommended.
6. Bio feedback is used to provide patient with information concerning bodily function that are not usually controllable.
7. Transelectrical nerve stimulation (TENS) is used to reduce pain.
8. Arthrocentesis can be done to lavage the TMJ and increase the joint mobility.
9. Acupuncture and other nerve treatment choices can also be used to reduce pain and other symptoms.

FURTHER READING

1. Archer WH — Oral and maxillofacial surgery, 5th ed, Vol. 2.
2. Bell WE — Temporomandibular disorders, 3rd ed.
3. Bush, Dolwick — The temporomandibular joint and related orofacial disorders.
4. Hermann S Sailer — Transplantation of lyophilised cartilage in maxillofacial surgery - experimental foundations and clinical success.
5. Jeffrey P Okeson — Management of temporomandibular disorders and occlusion, 5th ed.
6. Peterson, Ellis, Hupp, Tucker — Contemporary oral and maxillofacial surgery, 4th ed, 2006.
7. Sanders, Murakami, Clark — Diagnostics and surgical arthroscopy of the temporomandibular joint.

Surgical Procedures in Orthodontics— Orthodontic Surgery

18

Orthodontic surgeries refers to the surgical procedures carried out as an adjunct or in conjunction with orthodontic treatment. These surgical procedures are usually carried out to eliminate an etiologic factor or to correct severe dento-facial abnormalities that cannot be satisfactory treated by growth modification procedures or orthodontic camouflage.

Various surgical orthodontic procedures:

1. Orthodontic extractions
2. Surgical uncovering of teeth
3. Frenectomy
4. Pericision
5. Transplantation of teeth
6. Corticotomy
7. Orthognathic surgery
8. Surgical corrections in cleft lip and palate patients.
9. Surgical assisted rapid maxillary expansion.

STUDY OF SOME ORTHODONTIC SURGICAL PROCEDURES

I. *Pericision:*

Pericision or circumferential supra-crestal fibrotomy is done to prevent the relapse tendency of the stretched gingival fibres in case of orthodontic derotation. If this supracrestal fibres i.e the trans-septal and alveolar crest group of fibres are sectioned and allowed to heal according to the

derotated position, the relapse can be avoided. In this procedure, a no. 11 B.P blade or narrow scalpel is passed through the gingival sulcus to a depth of 2 mm apical to the alveolar crest on all the surfaces of the derotated tooth. This procedure is done as an adjuvant retention procedure after correction of rotation.

II. *Corticotomy:*

Corticotomy is a surgical procedure usually undertaken in patients having dental proclination with spacing. This procedure involves the sectioning of the dentoalveolar region into small units to hasten orthodontic tooth movement. Here interdental bony cuts are made parallel to the long axis of the tooth. Which may be joined together by horizontal bony cuts above the apices of the roots. Following this surgery, orthodontic tooth movement is initiated using fixed appliances.

III. *Orthognathic surgery:*

Orthognathic surgery is the surgical correction of skeletal anomalies or malformations involving the mandible or maxilla.

Indications of orthognathic surgery:-

Orthognathic surgery is used to correct any severe dentoalveolar discrepancy which is too severe for being corrected by orthodontics alone.

Contraindications of orthognathic surgery:-

Orthognathic surgery is not done in severe systemic and general health deprived patients.

Goals of orthognathic surgery:-

1. To restore normal masticatory, speech, ocular and respiratory functions.
2. To restore normal facial harmony and balances
3. To prevent short and long term relapse of orthodontic treatment
4. To minimize the treatment time.

Basic forms of facial deformities:-

The basic forms of dental deformities are:

1. Along the anteroposterior dimension:-

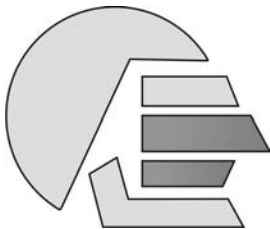


Fig. 18.1A: Prognathic maxilla

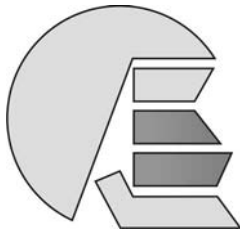


Fig. 18.1B: Retrognathic maxilla

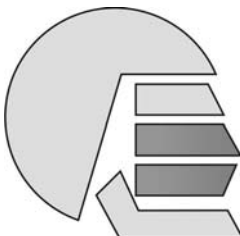


Fig. 18.1C: Bimaxillary protrusion

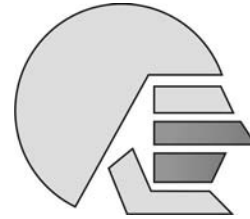


Fig. 18.1D: Retrognathic mandible

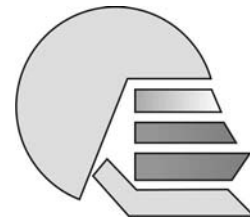


Fig. 18.1E: Prognathic mandible

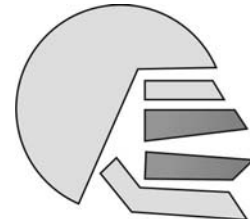


Fig. 18.1F: Apertognathia

2. Along the vertical dimension:-

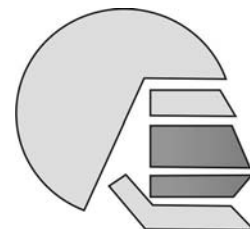


Fig. 18.2A: Maxillary excess

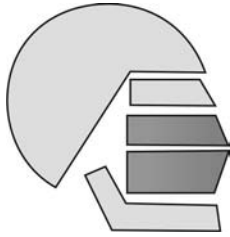


Fig. 18.2B: Mandibular excess

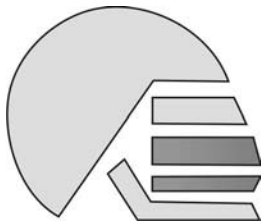


Fig. 18.2C: Mandibular deficiency

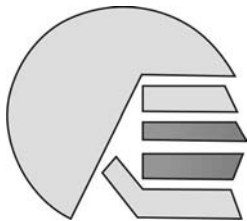


Fig. 18.2D: Maxillary deficiency

3. Along transverse direction:-



Fig. 18.3A: Maxillary transverse excess

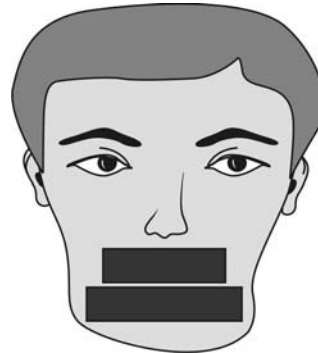


Fig. 18.3B: Maxillary transverse deficiency



Fig. 18.3C: Facial asymmetry

Pre-operative diagnosis and evaluation: A proper pre-operative diagnosis should be done for planning the surgical procedure. This is done by the combination of the following methods:

1. Clinical examination of the medical health of the patient, local examination of the hard and soft tissues.
2. Socio-psychological evaluation to know about the patient's desires, need and knowledge towards the procedure.
3. Radiographic evaluation by intraoral and extraoral radiographs to evaluate the dental conditions and supportive bone.
4. Cephalometric evaluation to determine the skeletal discrepancies present and plan the surgery needed.
5. Study model evaluation is done to evaluate three-dimensional inter-arch, intra-arch and occlusal discrepancies.

Facial Symmetry Assessment

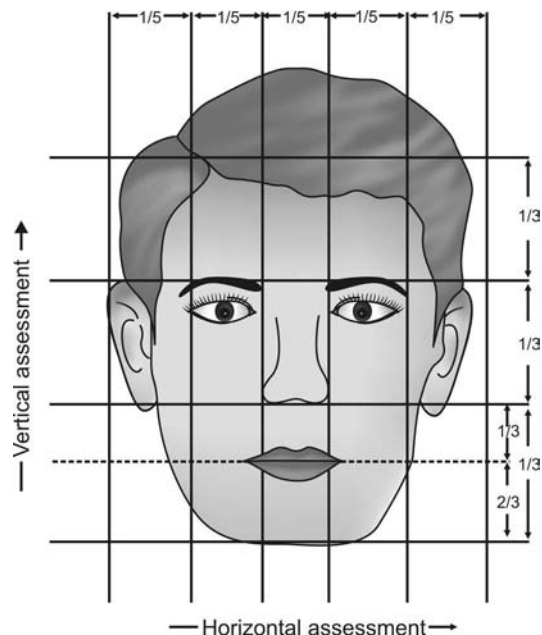


Fig. 18.4: Facial symmetry assessment

Features of Maxillofacial Deformities:

Sl.No.	Deformity	Clinical features	Skeletal features	Dental features
1.	Maxillary sagittal deficiency	- Concave facial profile - Retrusive upper lip - Acute nasolabial angle - Alar base narrow - Lack of dental display	- lower lip thin. - SNA decreased - SNB normal	- Class III - maxillary dental crowding - maxillary incisor procline - Mandibular incisors normal or retroclined
2.	Maxillary sagittal excess	- Convex facial profile - obtuse nasolabial angle.	- ANB increased - SNA increased - SNB normal	

Contd...

Contd...

Sl.No.	Deformity	Clinical features	Skeletal features	Dental features
3.	Maxillary vertical excess	- convex profile - lower facial height increased. - Alar base constricted - Nasolabial angle obtuse - Excessive gingival show - Excessive incisor show - lip incompetence - mentalis strain with lip closure - chin vertically long, retruded.	- ANB increased - lower facial height increased - SNA decreased - SNB decreased - ANB increased - Mandibular plane angle = steep - palatal-occlusal plane increased	- Class II, Class I - anterior open bite - maxillary arch constricted - curve of Spee, flat - accentuated - dental crowding.
4.	Maxillary deficiency	- concave facial profile - lower facial height decreased. - Nasolabial angle acute. - Alar base widened. - lack of incisor show - edentulous appearance - chin protruded.	- lower facial height decreased - SNB increased - ANB negative - palatal occlusal plane decreased - Mandibular plane angle = acute	- Class II, class I - deep bite - curve of Spee is reverse. - crowding
5.	Mandibular deficiency	- convex profile - retruded chin - deep labio-mental crease - mentalis strain with lip closure - lower lip everted	- SNA normal - SNB decreased - ANB increased - Ar-Gn decreased	- Class II - Mandibular incisor proclined - maxillary incisor retroclined - curve of Spee accentuated
6.	Mandibular excess	- lower lip everted - concave profile - midface appears deficient - lower third broad - lower lip thin	- SNA normal - SNB decreased - ANB decreased	- Class II - maxillary incisor proclined - Mandibular incisors retroclined.

Different orthognathic surgical procedures:-

1. Procedures to correct maxillary excess;
 - i. Anterior maxillary osteotomy by Wassmund's technique or Wunderer's technique
 - ii. Total maxillary osteotomy
 - iii. Maxillary segmental osteotomy
2. Procedures to correct maxillary deficiency;
 - i. Le fort I advancement osteotomy
 - ii. Inferior repositioning of maxilla and interpositional bone graft.
 - iii. Le fort III osteotomy
3. Procedures to correct Mandibular excess:
 - i. Mandibular body osteotomy
 - ii. Mandibular anterior subapical segmental osteotomy
 - iii. Vertical ramus osteotomy
 - iv. Sagittal split osteotomy
4. Procedures to correct Mandibular deficiency:
 - i. Vertical osteotomy of maxilla and interpositional bone graft
 - ii. Modified 'C' osteotomy
 - iii. Total subapical osteotomy
 - iv. Mandibular inferior border osteotomy (genioplasty)
 - v. Inverted 'L' osteotomy
5. Procedures to correct facial asymmetry:
 - i. Maxillary and Mandibular osteotomy, genioplasty and inferior border recontouring

Explanation of Various Osteotomy Procedures

1. Procedures to correct maxillary excess: (maxillary prognathism)
 - i. *Anterior maxillary osteotomy by Wassmund's or Wunderer's technique:* Anterior segment of the maxilla is repositioned to a retruded position by making it mobile. A bilateral vertical incision is made from canine region to nasal aperture from buccal sulcus and the palatal flap is tunneled to make the segment mobile, which is repositioned after removal of 1st premolar. (Wassmund's technique) (Fig. 18.5). A bilateral transverse incision is made from 1st premolar region to nasal aperture from buccal sulcus and the palatal flap is tunneled to make the segment mobile, which is repositioned after removal of 2nd premolar (Wunderer's technique) (Fig. 18.6).

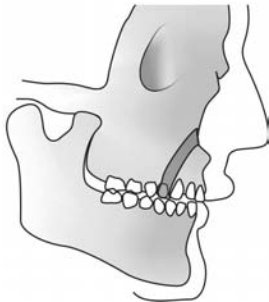


Fig. 18.5: Wassmund technique

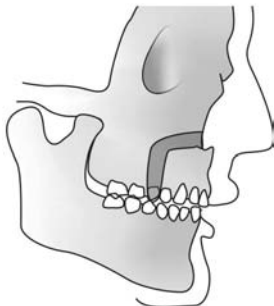


Fig. 18.6: Wunderer technique

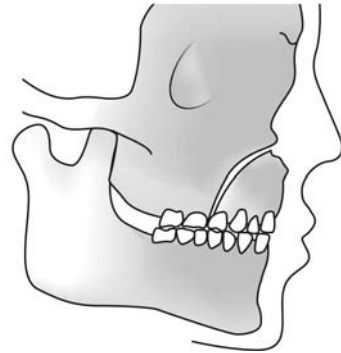


Fig. 18.7: Post-treatment — anterior maxillary osteotomy

- ii. Total maxillary osteotomy:-

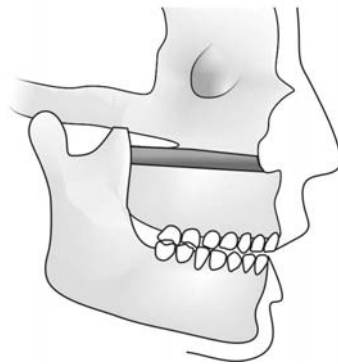


Fig. 18.8: Pre-treatment — maxillary prognathic

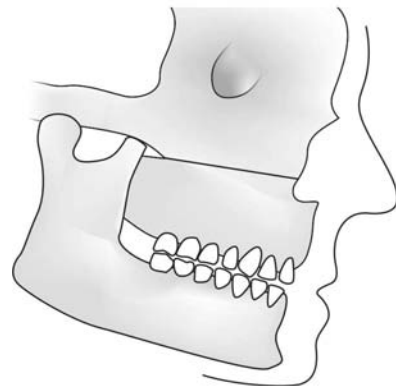


Fig. 18.9: Post-treatment — Total maxillary osteotomy

- iii. Maxillary segmental osteotomy (closure of tooth space):-

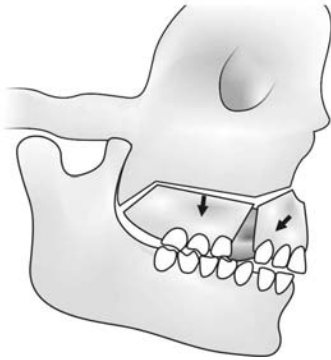


Fig. 18.10: Post-treatment — Maxillary segmental osteotomy

2. *Procedures to correct maxillary deficiency:*
(Maxillary retrognathism)

i. Le fort I advanced osteotomy

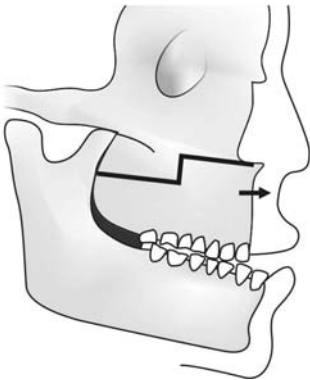


Fig. 18.11: Pre-treatment — Lefort I osteotomy

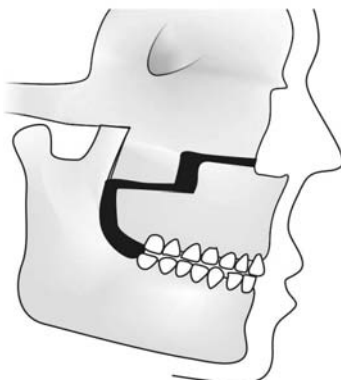


Fig. 18.12: Post-treatment — Lefort I osteotomy

ii. Inferior repositioning of maxilla and interpositional bone graft

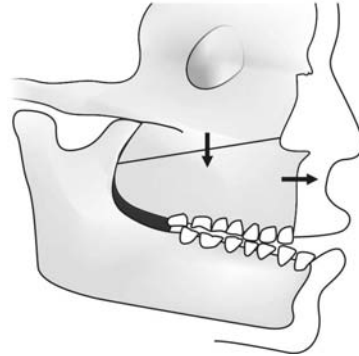


Fig. 18.13: Pre-treatment — Retrognathism maxillary

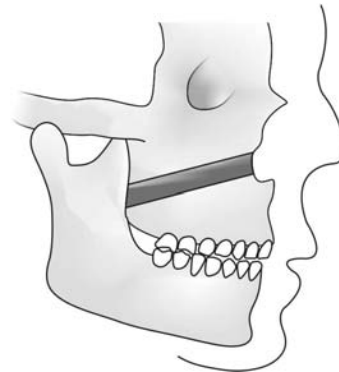


Fig. 18.14: Post-treatment — Interpositional graft

iii. Le fort III osteotomy

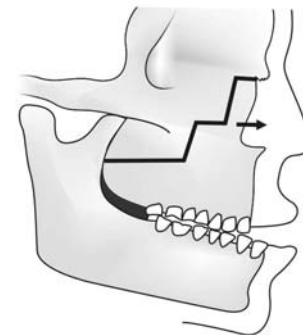


Fig. 18.15: Pre-treatment — Retrognathism maxillary

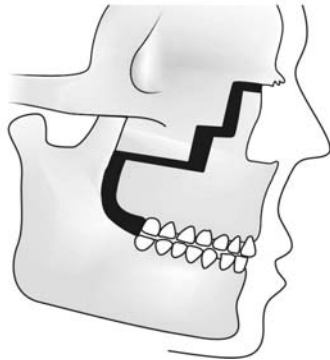


Fig. 18.16: Post-treatment — Lefort III osteotomy

3. *Procedures to correct Mandibular excess:*
(Mandibular prognathism)

i. Mandibular body osteotomy:-

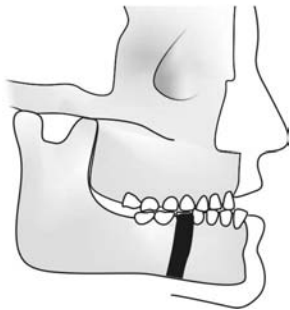


Fig. 18.17: Pre-treatment — Mandibular prognathism

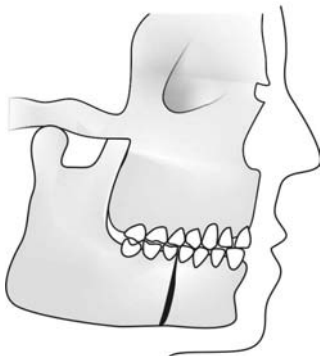


Fig. 18.18: Post-treatment — Mandibular body osteotomy

ii. Mandibular anterior subapical segmental osteotomy:-

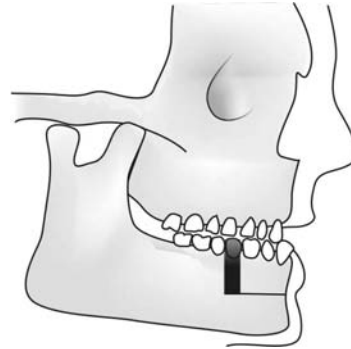


Fig. 18.19: Pre-treatment — Mandibular prognathism

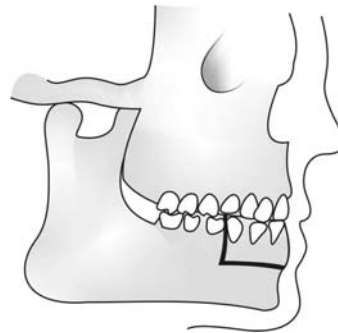


Fig. 18.20: Post-treatment — Subapical segmental osteotomy

iii. Vertical ramus osteotomy

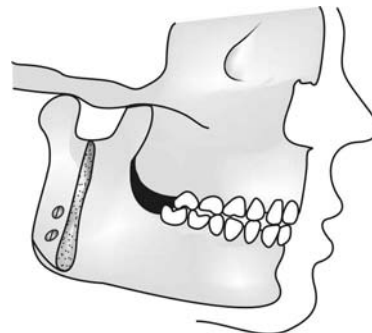


Fig. 18.21: Vertical ramus osteotomy to correct prognathic mandible

- iv. *Sagittal split osteotomy*: Here the ramus of the mandible is divided by creation of horizontal osteotomy on medial aspect and vertical osteotomy on lateral aspect of mandible. These are connected by anterior ramus osteotomy. Lateral cortex of mandible is then separated from medial aspect and mandible can be advanced or set back for correction of mandibular retrognathism or prognathism respectively (Fig. 18.22).

The advantages of this procedure are:

- Highly cosmetic (as it is done intraorally)
- Broad bony contact of the osteotomised segments ensure good healing.
- There is no need of graft for advance of mandible. Thus donor site morbidity and a second operation site (for the graft) is totally avoided.

The disadvantage is that it demands a high level of operative skill and experience to minimize the complication.

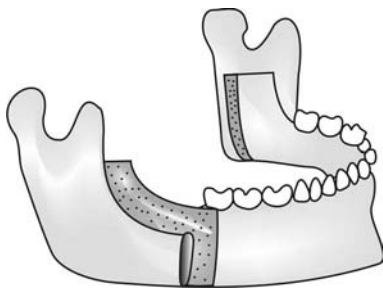


Fig. 18.22: Sagittal split osteotomy to correct prognathic mandible

4. Procedures to correct Mandibular deficiency: (Mandibular retrognathism)
- i. Vertical osteotomy of mandible and interpositioned bone graft:

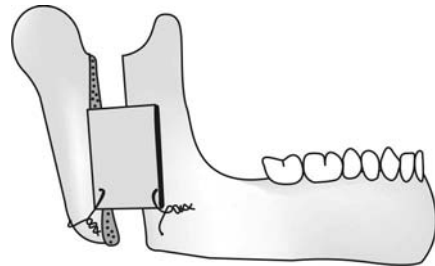


Fig. 18.23: Interpositioned bone graft

- ii. Modified 'C' osteotomy

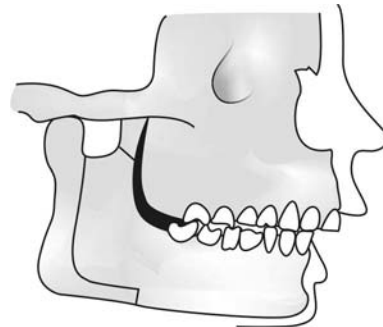


Fig. 18.24: Pre-treatment — Mandibular retrognathism

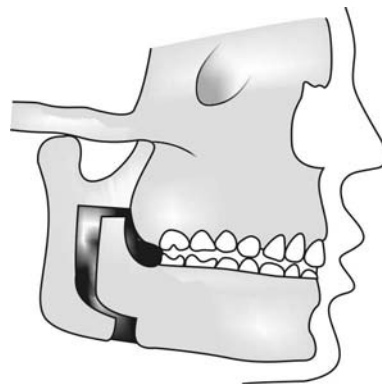


Fig. 18.25: Post-treatment — Modified 'C' osteotomy

iii. Total subapical osteotomy

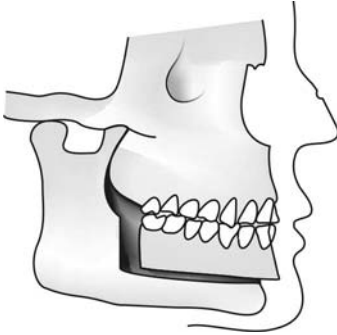


Fig. 18.26: Total subapical osteotomy to correct mandibular retrognathism

v. Inverted 'L' osteotomy

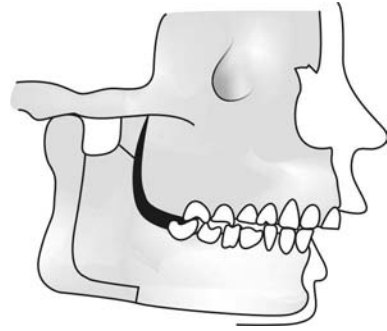


Fig. 18.28: Pre-treatment — retrognathism mandibular

iv. *Mandibular inferior border osteotomy (genioplasty)*: It is a horizontal osteotomy procedure of the symphysis region where the segmental bony section can be either advanced, reduced, augmented using bone grafts or straightened to correct retruded chin, enlarged chin, short chin or protruded chin respectively (Fig. 18.27)

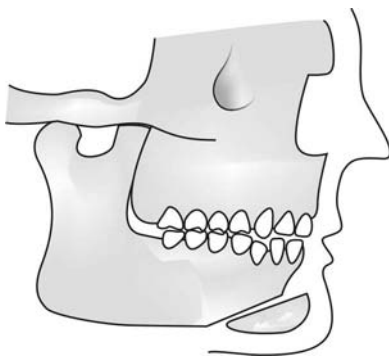


Fig. 18.27: Advancement of chin in short chin genioplasty

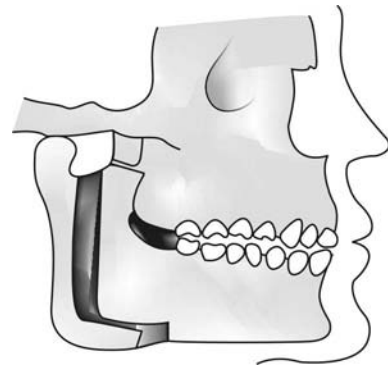


Fig. 18.29: Post-treatment — Inverted 'L' osteotomy

IV. CLEFT LIP AND CLEFT PALATE

Cleft lip is a birth defect that result in a unilateral or bilateral opening in the upper lip between the mouth and the nose. It is also called as harelip.

Cleft palate is a birth defect characterized by an opening in the roof of the mouth caused by a lack of tissue development.

Etiology of Facial Clefts

1. *Hereditary*:-
 - i. Monogenic theory
 - ii. Polygenic theory
 - iii. Multifactorial threshold hypothesis
2. *Congenital*:-
 - i. Infections:
Rubella, influenza
 - ii. Drugs:
Cortisone, thalidomide
 - iii. Radiations:
X-rays. R-rays.
 - iv. Diet:
Deficiency of vitamin B₂, folic acid and increased vitamin A.

Difficulties and Problems Due to Facial Clefts

1. Psychological problems faced due to abnormal facial appearance
2. Speech and hearing problems
3. Dental problems of other congenital disease and abnormal soft and hard tissues.
4. Esthetic problems due to facial disfigurement.

Classification of Orofacial Cleft

I. Veau's classification:

Veau has classified clefts into four groups:

- Group 1: They are clefts involving the soft palate only
- Group 2: They are clefts of the hard and soft palate extending upto the incisive foramen.
- Group 3: They are complete unilateral clefts involving the soft palate, the hard palate, lip and the alveolar ridge.
- Group 4: They are complete bilateral clefts affecting the soft palate, the hard palate, the lip and alveolar ridge.

II. Kernahan's stripped 'Y' classification: It is a symbolic classification put forward by Kernahan and Stark (Fig. 18.30).

The classification uses a stripped 'Y' having numbered blocks. Each block represents a specific area of the oral cavity.

Block 1 and 4 — lip

Block 2 and 5 — alveolus.

Block 3 and 6 — hard palate anterior to the incisive foramen

Block 7 and 8 — hard palate posterior to incisive foramen

Block 9 — soft palate.

These boxes are shaded in areas where the cleft has occurred.

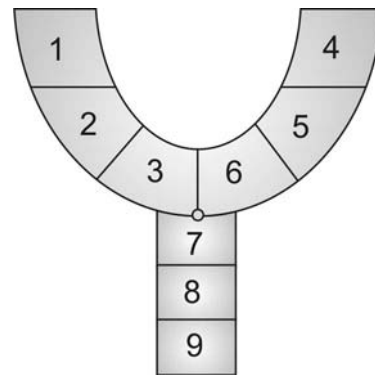


Fig. 18.30: Stripped 'Y' classification

Timing of Surgical Repair

Cleft lip is generally repaired during 3-4 months of age. This is done following the rule of 10's. This rule states - 10 weeks of age, 10 pounds of weight, and atleast 10 gm / dl of hemoglobin.

Cleft palate is generally repaired during 6-8 months depending on the growth of the baby and surgeon's choice. Early repair of cleft palate have the following advantages:

1. Better palatal and pharyngeal muscle
2. Ease of feeding
3. Better development of phonation skill
4. Better hygiene maintaince
5. Improved psychologic states for parents and baby

- But the disadvantages of early closure are:
1. Surgical correction is more difficult in younger children with small structures
 2. Scar formation resulting from surgery causes maxillary growth restriction.

Management of Orofacial Clefts

A multidisciplinary approach involving plastic surgery, orthodontics, speech pathology, neurosurgeon, psychiatrist, oro- maxillofacial surgeon, ENT department, prosthodontics and pediatrics department is needed to rehabilitate the cleft cases. This approach to the problem results in esthetically accepted end result without much functional deficiencies.

The treatment protocol for management of cleft lip and cleft palate is:

1. At birth — pediatric consultation and feeding instructions are given.
2. At 10 -12 weeks — Evaluation and surgical repair of the lip is done. (In India, it is performed in 3-6 months).
3. At 12-18 months — Evaluation and surgical repair of palate and placement of pressure equalization tubes is done.
4. At 3-6 years — Evaluation and medical treatment, speech therapy, soft palate lengthening, fistula repair and psychological evaluation is done.
5. At 5-6 years — lip and nose treatment and pharyngeal surgery is performed
6. At 7 years — phase I orthodontic treatment is done.
7. At 9-11 years — pre alveolar bone graft are placed
8. At 12 years or later — phase II or complete orthodontic treatment is done
9. At 15 - 18 years — In this phase, placement of implants are done, after completing orthodontic treatment.
10. At 18-21 years — After growth cessation, surgical advancement of maxilla is done.

Cheilorrhaphy (surgical correction of cleft lip)

Several types of cleft lip operation have been described for unilateral cleft lip. The most common used operative are Millard's rotation advancement flap and Tennison-Randall triangular flap methods. Bilateral cleft lip can be repaired in two stages by the above mentioned procedures or in a single stage by Veau III procedure, Millard's single stage procedure or black procedure.

1. *Millard's rotation advancement flap surgery:*
In Millard's repair rotation flap(a) and Columella flap (c) as in Fig. 18.31 are planned on the medial side of the cleft. After full thickness of the lip is cut along the marking a rotation gap is produced on the medial side which is filled by an advancement flap (b) as in Fig. 18.31 planned on the lateral side of cleft. In this method the minimal tissue is discarded and the result can be modified during the surgery (Fig. 18.32).
2. *Tennison- Randall Triangular flap surgery:* A triangular flap is created on the lateral side of the cleft to fit into the triangular defect produced on the medial side of the cleft (Fig. 18.33). This procedure can be planned exactly after initial measurements. The result

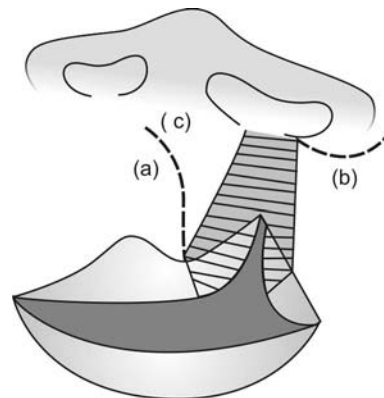


Fig. 18.31: Incision lines — Millard's rotation flap

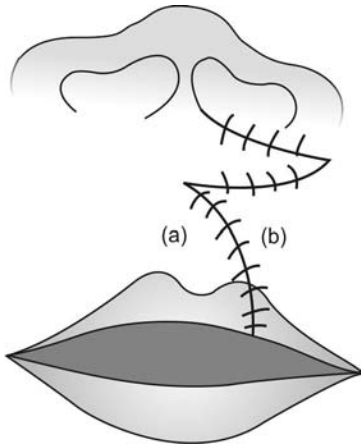


Fig. 18.32: Sutures placed

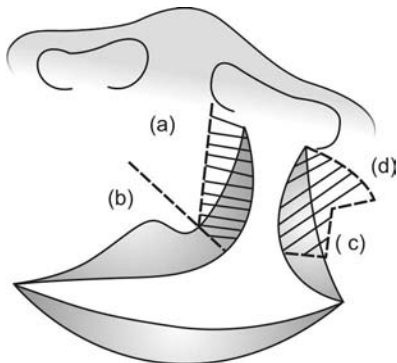


Fig. 18.33: Incision lines — Tennison randall flap

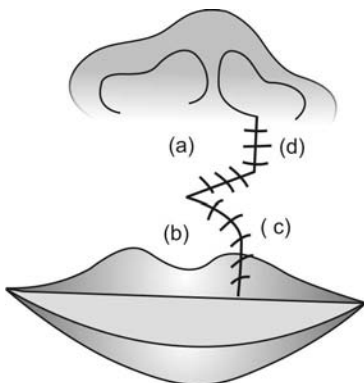


Fig. 18.34: Sutures placed

cannot be modified once the lip is cut. The scar is more prominent than in other procedure (Fig. 18.34).

3. *Veau III single stage procedure:* It is the simplest one stage straight line closure and produces satisfactory result in a bilateral cleft lip (Fig. 18.35). In this method vermilion flap from either lateral side of the cleft is brought down over the prolabium to augment the vermilion in the centre of the upper lip (Fig. 18.36).

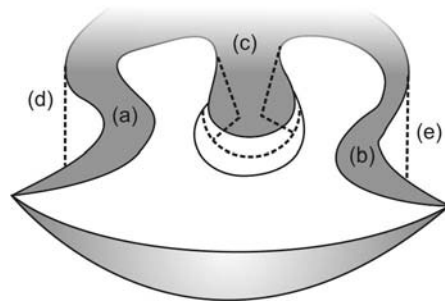


Fig. 18.35: Incision line — Veau III procedure

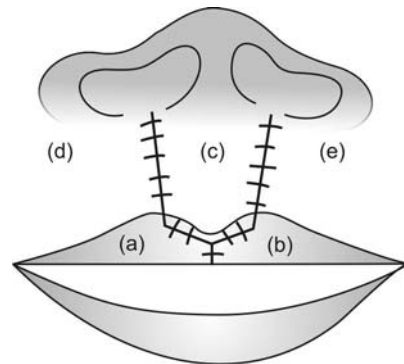


Fig. 18.36: Sutures placed

Palatorrhaphy (surgical correction of cleft palate)

Palatorrhaphy can be either done in two stage where soft palate is repaired before 18 months followed by obturation of hard palate till hard palate repair at 4-5 years, or done in one stage.

There are many procedures for single stage repair like Von Langenbeck repair, Veau- Wardill-Kilner V-Y push back palatoplasty and double opposing z - plasty of Furlow.

1. Veau - Wardill- Kilnar V-Y push back palatoplasty:

Here, two mucoperiosteal flaps are raised from a hard palate and nasal layers are mobilized. Abnormal attachments of palatal muscles are divided from the posterior border of the hard palate to be sutured in midline to the opposite side of the palatal muscle (Fig. 18.38).

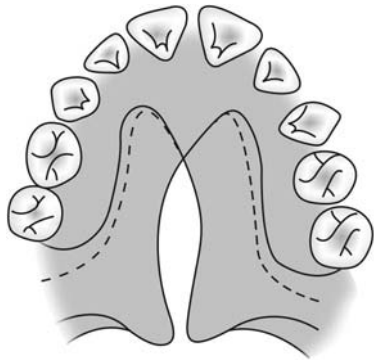


Fig. 18.37: Pre-operative — Cleft palatal

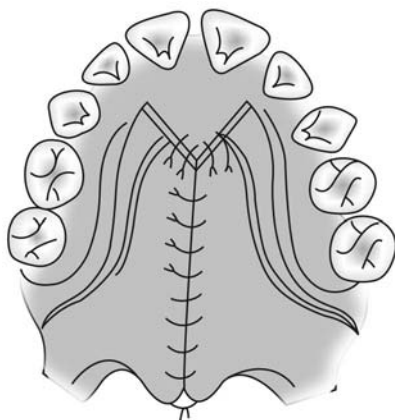


Fig. 18.38: Post-operative — Palatorrhaphy

DISTRACTION OSTEOGENESIS

It is a process by which controlled and calculated, lengthening and widening of bone is achieved according to need of the patient as per described by the surgeon.

In this technique, an appliance known as distracter applies gradual force for lengthening and widening of the bone.

Indications

1. Unilateral hypoplasia of the mandible
2. Severe retrognathic
3. Non-syndromic Mandibular hypoplasia associated with dental malocclusion
4. Mandibular hypoplasia due to trauma
5. Mandibular resection
6. Shortened vertical height
7. Maxillary hypoplasia

Contraindications

1. Un-cooperative patients
2. Small fragile bones in the area of placement of distraction device
3. Atrophied bony areas
4. In older- patients

Advantages

1. Distraction osteogenesis produce less pain and swelling than the traditional procedures
2. It eliminates the need for bone grafts
3. It provides greater stability in major cases
4. Overcorrection is possible
5. No facial surgical incisions present hence esthetically accepted.

Disadvantages

1. Two visits of the patient to the surgeon is necessary, to monitor presence of any infection and teach how to activate appliance.

2. A second minor surgical procedure is necessary to remove the distraction appliance.
3. In case of extraoral devices, patient co-operation is difficult and scars may result.

Types of Distractors

They can be of two types:

1. Extra oral distractors
2. Intra oral distractors.

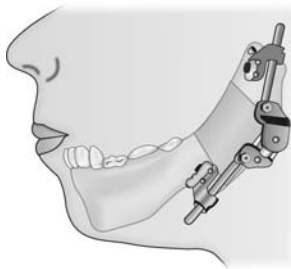


Fig. 18.39: Distraction osteogenesis
(For color version see plate 5)

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Neurogenic Disorders of Maxillofacial Region

19

Definitions

1. Analgesia — It is absence of pain in response to stimulation that would normally be painful.
2. Anesthesia — It is absence of all sensation
3. Neuralgia — It is a condition of pain in the distribution of a nerve or nerves.
4. Neuropathy — It is disturbance of function or pathologic change in a nerve
5. Paresthesia — It is abnormal sensation, whether spontaneous or evoked.
6. Paresis — It is incomplete paralysis.

CLASSIFICATION OF NEUROGENIC DISORDERS

1. Traumatic injuries
 - i. Neurapraxia
 - ii. Axonotmesis
 - iii. Neurotmesis
 - iv. Traumatic neuroma
2. Inflammation
 - i. Neuritis
3. Neuralgias
 - i. Trigeminal nerve neuralgia
 - ii. Bell's palsy
 - iii. Glossopharyngeal neuralgia
 - iv. Sphenopalatine neuralgia
4. Special type of injuries
 - i. Infection injuries

- ii. Irradiation
- iii. Compression neuropathies
5. Tumors
 - i. Benign and malignant.

STUDY OF SOME NEUROGENIC DISORDERS

I. Traumatic Injuries

1. *Neurapraxia*:
It is a physiologic paralysis of the conduction of intact nerve fibres as a result of stretching or distortion without organic rupture.

Causes

- Bone fragments
- Tourniquet
- Plaster cast
- Postoperative.

Features

- Parasthesia
- Weakness of muscle

Treatment

- Self correcting condition
 - Splinting the limb in position of relaxation.
2. *Axonotmesis*:
It is the rupture of the nerve fibres (anatomical disruption of axon) within an intact nerve sheath.

Causes

- Severe injuries
- Fracture segments

Features

- Anesthesia
- Paresthesia
- Weakness of muscle
- Paralysis of muscle

Treatment

- Splinting of the limb.
- Care of the skin
- Maintain nutrition of the limb
- Surgical exploration of the nerve

The progress or regeneration is checked by: Tinel's sign: Percussion with a hammer on the course of the nerve, will produce tingling sensation if regeneration occurs.

3. Neurotmesis:

It is the accidental division (can be partial or complete division) of the nerve fibres and nerve sheath.

Causes

- During parotidectomy (facial nerve)
- Sarcoma of limb (lower limb nerves)
- Thyroidectomy (Recurrent laryngeal nerve)
- Surgery at mandibular third molar (inferior alveolar and lingual nerve)
- Surgery at the region of mental nerve (mental nerve)

There is a complete parasthesia of the area affected.

Treatment

- Prevent infection, contamination and tension at the area of injury.
- Surgical repair of the nerve.

II. Trigeminal Neuralgia

It is also called as "Tic douloureux", Trifacial neuralgia and Fothergill's disease. It is called as "Tic douloureux" because of the twitching of the facial muscles of the affected site during the attacks.

Trigeminal neuralgia is the neuralgia of the Vth cranial nerve (trigeminal nerve). There is specific painful flexion of the face characterized by momentary or repeated paroxysmal attack of pain in one or more divisions of the trigeminal nerve usually initiated by irritation of trigger zone.

Trigeminal neuralgia is a sudden, usually unilateral, severe, brief, stabbing, lancinating, recurring pain in the distribution of one or more branches of the trigeminal nerve.

Etiology

1. Hypersensitivity of the trigeminal nucleus, abnormal hyper excitability of nerve elements of brainstem and thalamus disturbances.
2. Allergic reaction because of excessive accumulation of histamine
3. Pressure changes in the superficial petrosal sinus or compression by tumor in the area.
4. Deficiency of inhibitor in CNS, GABA.
5. Circulatory insufficiency to the gasserian ganglion
6. Along with multiple sclerosis
7. Dental pathosis

Clinical Features

1. Older females are mostly affected
2. Maxillary and mandibular division of the nerve are mostly affected
3. Severe paroxysmal pain
4. Unilateral location
5. Mild superficial stimulation provokes pain
6. Frequently pain free periods between attacks
7. No neurologic deficits
8. No dentoalveolar cause found

9. Local anesthesia of trigger zone temporarily arrests pain.

Diagnosis

1. Mainly done by the examination of the characteristic clinical features along with the trigger zones.
2. CT Scan and MRI is done to diagnose the postoperative causes, neuritis and vessel compression.
3. Response of Tab. Carbamazepine - universal response is seen in case of trigeminal neuralgia and is not seen in case of any other pain.

Treatment

Treatment is done by combination of medical and surgical methods.

1. *Medical:*
 - a. Carbamazepine 100 mg t.i.d x 5 weeks. (Drug of choice)
 - b. Phenitoin, sodium valproate, amitriptyline, gabapentine, felbamata
 - c. Trichloroethylene
 - d. Morphine I.M
 - e. Nicotinic acid
 - f. Vitamin B₁₂
 - g. HCl administration
 - h. Acupuncture
 - i. Hypnosis
2. *Surgical:* (Interruption of pain pathway between the central and periphery).
 - a. Extra cranial methods:-
 - i. Alcohol blocks in peripheral nerve
 - ii. Hot water and local anesthetic injection
 - iii. Nerve section and avulsion
 - iv. Electrosurgery
 - v. Cryosurgery
 - vi. Radiotherapy (thermocoagulation)
 - b. Intracranial methods:-
 - i. Alcohol blockage in gasserian ganglion
 - ii. Retrogasserian rhizotomy
 - iii. Radiofrequency thermogangliolysis (RFTG) at gasserian ganglion

- iv. Mid brain tractotomy
- v. Medullary tractotomy
- vi. Intracranial nerve decompression.

Peripheral nerve injection: Alcohol, hot water and LA injections can be given into maxillary and mandibular nerves. It is mostly given in infraorbital nerve, inferior alveolar nerve and mental nerve.

Nerve section and Avulsion: Also called as Peripheral neurectomy. This procedure is performed under general anesthesia and is indicated in patients where other complex surgeries are contraindicated. It is done in infraorbital nerve, inferior alveolar nerve, mental nerve and rarely lingual nerve. The disadvantage is the occurrence of parasthesia or deep anesthesia of the area.

Avulsion of nerve is done from soft tissue and bone for better results. Minimum of 1 cm of the nerve should be removed and all the peripheral branches should be removed. Nerve end is cauterized and foramen should be plugged by non-absorbable material.

Cryosurgery: It is a simple, easier and safer procedure. Here cryotherapy probe at temperature cooler than -60°C is applied on the concerned nerve. Cryo probe (N₂O probe) is applied for 1-2 min. followed by 3 min rest and this procedure is done for 3 times. The disadvantage is that recurrence is faster

Radiofrequency thermo coagulation: It is a relatively newer, preferred and reliable treatment. Radiofrequency that can destroy pain fibres are used and the pain fibres are destroyed.

Alcohol blockage in gasserian ganglion: Glycerol or absolute alcohol is used commonly which causes ganglion neurolysis by dehydration.

Retrogasserian Rhizotomy: Here preganglionic trigeminal sensory roots are sectioned between the gasserian ganglion and point of entry into the pons. It is done when other procedures fail.

Radiofrequency thermogangliolysis at gasserian ganglion: This procedure is preferred as it can be done in older patients and compromised patients. It is a simple, accurate, faster and cheaper process, it has low rate of recurrence and avoids eye damage.

1-2, thermal lesioning at 60°C - 70°C for 30 second each are given for achieving result.

Tractotomy procedure: This procedure is rarely done and here incision of descending trigeminal nerve tract is done.

Intracranial nerve decompression: This technique is a newer one and here open craniotomy approach is done. The arteries and nerves are reached and separated by a sponge or Teflon wool placed between them.

III. Bell's Palsy

It is an idiopathic paralysis of the VIIth cranial nerve - facial nerve.

Etiology:

The etiology is unknown but it is thought to have been caused by ischemia of nerve near the stylomastoid foramen resulting in edema of the nerve, its compression in the bony canal and finally paralysis

Clinical Features

1. Middle aged females are mostly affected
2. Bell's sign = when patient closes eye, the eye globe turns upwards and there is slight movement of upper eyelid (Fig. 19.2).
3. Altered lacrimal and salivary secretion
4. Voluntary movements are affected, whereas emotional movements are less affected.
5. Dysfunctioning of the upper face, inability to wrinkle and deviation of the angle of mouth with saliva dribbling from mouth (Fig. 19.1).
6. Mask like face, slurry speech and difficulty in eating and drinking
7. Food lodgment poor oral hygiene, injections and halitosis.



Fig. 19.1: Appearance of a person with bells palsy

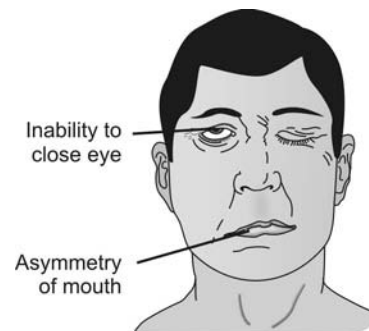


Fig. 19.2: Bell's sign

Treatment

1. Medical -
 - i. Beclamethasone 0.5 mg.
 - ii. Vitamin B₁₂ and other vitamins supplements.
 - iii. Supportive care.
2. Physiotherapy:-
This is done to maintain muscle tone. It can be combined with muscle massage and electric muscle stimulation.
3. Surgery:-
 - i. Nerve decompression surgery
 - ii. Nerve anastomoses
Reanimation of central end of hypoglossal or spinal accessory nerve and distal end of facial nerve.
 - iii. Nerve grafting done in case of neurons or loss of nerve in a region.

IV. Glossopharyngeal Neuralgia

It is a neuralgia of the IXth cranial nerve-glossopharyngeal nerve.

Features

1. The cause is unknown, but thought to be mainly due to neural ischemia.
2. Occurs in middle aged people
3. Pain and other features are similar to trigeminal neuralgia.
4. Trigger zones are present in the posterior oropharynx and tonsillar fossa. These are triggered by simple acts of swallowing, talking, yawning or coughing.
5. The condition is treated by resection of extracranial or intracranial portion of nerve.

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Fractures of the Jaw

20

Fracture is any breakage or discontinuity of a bone, tooth or any hard structure of body. It can be complete or incomplete.

APPLIED ANATOMY

The facial skeleton is divided into upper third, lower third and middle third.

Upper Facial Skeleton

This is formed chiefly of the frontal bone making the superior orbital margin and orbital roof. Craniofacial injuries rarely includes the fracture of this part as due to the cushioning effect protecting it.

Mid Facial Skeleton

This part is formed chiefly by the following bones:

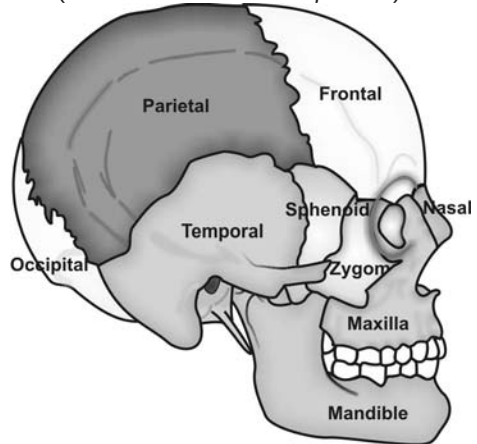
- 2 Maxilla
- 2 Zygomatic bones
- 2 Zygomatic process of the temporal bone
- 2 Palatine bones
- 2 Nasal bones
- 2 Lacrimal bones
- Vomer
- Ethmoid and its attached conchae
- 2 Inferior conchae
- Pterygoid plates of the sphenoid.

Lower Facial Skeleton

This part is formed chiefly by the mandible.



Fig. 20.1: The facial skeleton
(For color version see plate 5)



(For color version see plate 5)

ETIOLOGY OF DENTOFACIAL FRACTURE

The various etiologies in order of frequency are:

- i. Inter personal violence
- ii. Sporting injuries
- iii. Falls
- iv. Road traffic accidents
- v. Industrial trauma

TYPES OF FRACTURES

Various classifications of middle third fractures:

A. Lefort classification:

- I. Lefort I
- II. Lefort II
- III. Lefort III

B. Erich's classification: (as per direction of fracture line)

- i. Horizontal fracture
- ii. Pyramidal fracture
- iii. Transverse fracture

C. Depending on relation of fracture line to zygomatic bone:

- i. Subzygomatic fracture
- ii. Suprazygomatic fracture

D. Depending on level of fracture line:-

- i. Low level
- ii. Middle level
- iii. High level

E. Rowe and William's classification:

I. Fractures not involving the occlusion:-

1. Central region:

- a. Fractures of the nasal bones and/or nasal septum.
 - i. Lateral nasal injuries.
 - ii. Anterior nasal injuries.

b. Fractures of the frontal process of the maxilla.

c. Fractures of types (a) and (b) which extend into the ethmoid bone (naso-ethmoid)

d. Fractures of types (a), (b) and (c) which extend into the frontal bone (fronto- orbito-nasal dislocation)

2. Lateral region: Fractures involving the zygomatic bone, arch and maxilla (Zygomatic complex) excluding the dento-alveolar component.

II. Fractures involving the occlusion:-

1. Dentoalveolar

2. Subzygomatic:

- a. Lefort I (low level or Guerin)
- b. Lefort II (Pyramidal)

3. Suprazygomatic:

- c. Lefort III (high level or craniofacial dysfunctions).

F. Comprehensive classification:

1. Dentoalveolar fractures.
2. Zygomatic complex fractures
3. Nasal complex fractures
4. Lefort I, Guerin or low level fractures.
5. Lefort II, Pyramidal or infrazygomatic fractures.
6. Lefort III or Suprazygomatic fractures.
7. Craniofacial fractures.

Various classifications of mandibular fracture:

A. Depending on type of fracture (general) - (KRUGER)

1. Simple/closed:- Fracture that does not communicate with exterior. (Greenstick fracture - special type of simple fracture).
2. Compound/open:- Fracture that communicates with exterior. (E.g. Fracture involving tooth bearing portion).
3. Comminuted:- Fracture in which bone is splintered or crushed into multiple pieces. (E.g. gun shot wound, penetration wound)
4. Pathogenic:- Fracture caused in already weakened mandible by some pathogenic cause. (E.g. Osteomyelitis, neoplasm)
5. Impacted:- One fracture fragment driven into other fragment (mainly of maxillary fracture).
6. Greenstick fracture:- Cortex of bone is fractured and other cortex is bent (Seen in children because of high bone resiliency).

B. Depending on site of fracture (Fig. 20.3)

1. Dentoalveolar- 3 percent
2. Condylar- 16.8 percent
3. Coronoid
4. Ramus- 1.9 percent
5. Angle- 31.3 percent
6. Body (molar and premolar area)- 24.8 percent
7. Parasymphysis- 22.2 percent
8. Symphysis

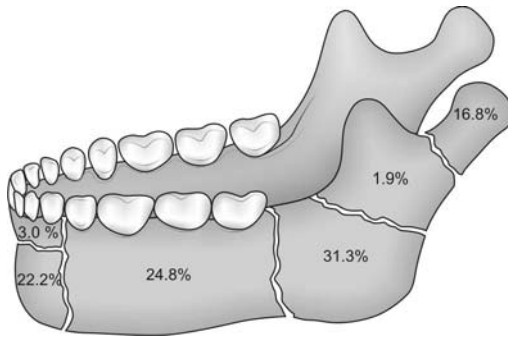


Fig. 20.3

C. Depending on cause

1. Direct violence
2. Indirect violence
3. Excessive muscular contraction.

D. Depending on treatment considerations

1. Unilateral
2. Bilateral
3. Multiple
4. Comminuted

E. According to direction of fracture and favorability of treatment

1. Horizontal favorable fracture. (fracture line along alveolar margin, downward and forward) (Fig. 20.4)
2. Horizontal unfavorable fracture (fracture line along alveolar margin, downward and backward) (Fig. 20.5)
3. Vertical favorable fracture. (fracture line from buccal plate, moving backward and lingually) (Fig. 20.6)
4. Vertical unfavorable fracture (fracture line from buccal plate, moving forward and lingually) (Fig. 20.7)

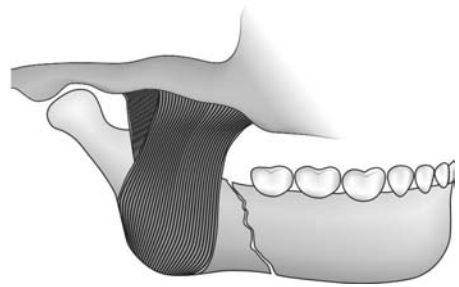


Fig. 20.4: Horizontal favourable fracture

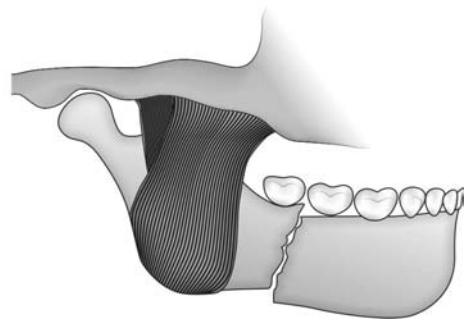


Fig. 20.5: Horizontal unfavourable fracture

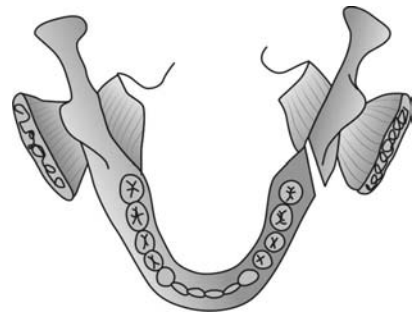


Fig. 20.6: Vertical favourable fracture

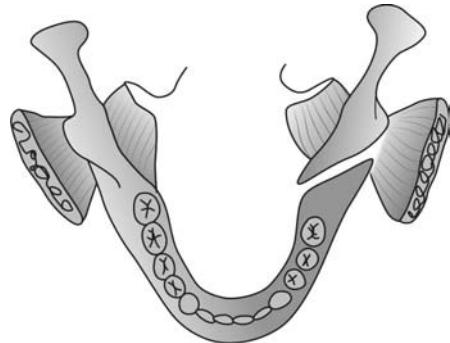


Fig. 20.7: Vertical unfavourable fracture

Favorable fractures are those when the muscular pull cannot displace the fractured parts and in unfavorable fracture the muscle pull displaces the parts.

Condylar head mostly displaces medially and forward under the influence of lateral pterygoid.

Coronoid process mostly displaces upward and towards infratemporal fossa under the influence of temporalis muscle.

- Guardsman's fracture- fracture of symphysis and both condyle by fall on the mid-point of the chin. Commonly seen in epileptics and elderly patients and in soldiers who faint in parade.
- Bucket Handle fracture- fracture of edentulous mandible seen in elderly patients (Fig. 20.8).

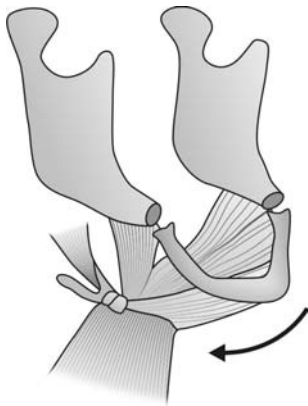


Fig. 20.8: Bucket handle fracture

GENERAL DIAGNOSIS OF A JAW FRACTURE

Diagnosis is done by proper history taking, examine the features and confirming by the various imaging techniques.

The imaging techniques used are

1. Plain radiographs:

The following plain views of the facial bones may be useful in diagnosis -

i. Upper third

- a. Modified Caldwell projection: The central beam is directed from behind

to pass through the frontal sinuses with the shadow of the dense petrous temporal bone lying just below the inferior orbital rim.

b. Lateral projection

ii. Middle third

- a. Occipitomental: The patient is upright with the nose and chin in contact with the plate. The central beam is angled at 10° or 30° above the horizontal, which throws the shadow of the dense petrous bone below the projection of the maxillary sinuses.

- b. Water's view: The central beam passes along the line of the orbital floor with the shadow of the dense petrous temporal bone overlapping the lower quarter of the maxillary sinuses. It is useful when there is an isolated orbital floor fracture.

c. Lateral projection

d. Occlusal view of the maxillae

- e. Periapical views of involved or damaged teeth.

iii. Mandible:-

- a. Postero-anterior projection (PA)

- b. Oblique lateral projection with the tube angled at 30° to the lower jaw.

- c. Rotated posterior-anterior projection.

- d. Occlusal views of the mandible.

- e. Periapical views of the involved or damaged teeth.



Fig. 20.9: Radiographic view of mandibular body fracture

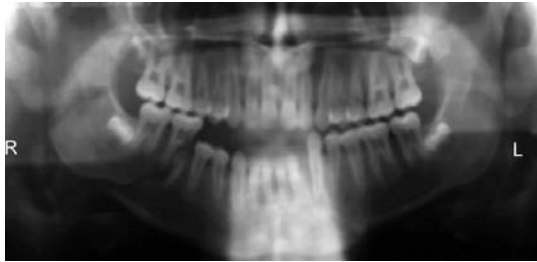


Fig. 20.10: Radiographic view of mandibular right angle fracture

2. Computerized tomography: Because of the easy availability and precise diagnosis nowadays CT scan is most widely used.
3. MRI
4. Intraoral radiography (IOPAR): This is used to demonstrate the relationship of the teeth in the line of fracture.
The radiographic findings are helpful to confirm;
 - The site of fracture
 - Direction and displacements of fragments.
 - Condition of teeth adjoining the fracture line.
 - Severity of damage of bone.
 - The presence of any bony pathology involving the fractured fragments like impacted tooth, cysts or neoplasm.

GENERAL TREATMENT OF A JAW FRACTURE

Basic Principles/Three Steps in Management

1. Preservation of life.
 2. Maintenance of function.
 3. Esthetic restoration.
1. *Preservation of life:* Immediate assessment and treatment of any life threatening injuries is done by-
 - A. Airway maintenance
 - B. Bleeding control
 - C. Consciousness restoration and circulation maintenance.

A. Airway maintenance:

Nonsurgical:

- Patient positioned supine with head sideways
- Removal of blood clot, foreign body, saliva, thick mucosa etc from oropharynx (oropharyngeal toilets) – done by bronchoscopy
- Anterior traction of tongue
- Position of soft palate.

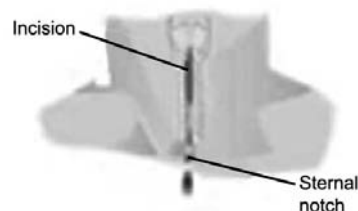
Surgical/Tracheostomy:

Done in following cases:

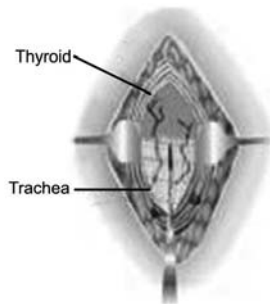
- When prolonged artificial ventilation is necessary (head and chest injury)
- GA administration procedure
- Ensure safe postoperative recovery.
- Injury to tongue and oropharynx
- Severe hemorrhage to airway.

Technique

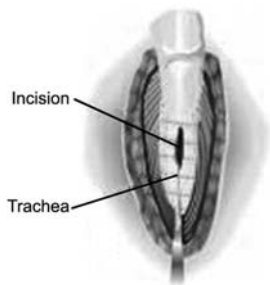
- i. Patient is intubated before surgery
- ii. Patient in supine position with neck extended
- iii. Vertical incision from midline of neck to lower border of cricoid is made (vertical) (Figs 20.11A and B) or Transverse incision from two finger below sternal notch is made (transverse)
Vertical method is done emergency is faster but transverse method is better in cosmetic beauty.
- iv. Skin and muscles are reflected and veins are retracted to expose the trachea (Fig. 20.11C and D).
- v. Four percent xylocaine is infiltrated into trachea.
- vi. Incision, suture and dressing are done (Fig. 20.11E).



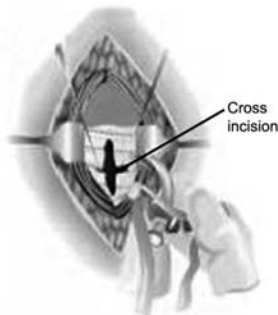
(A) Membrane covering trachea is divided



(B) Trachea is cut open



(C) Opening is enlarged

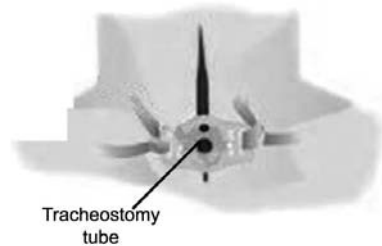


(D) Insertion of tracheostomy tube

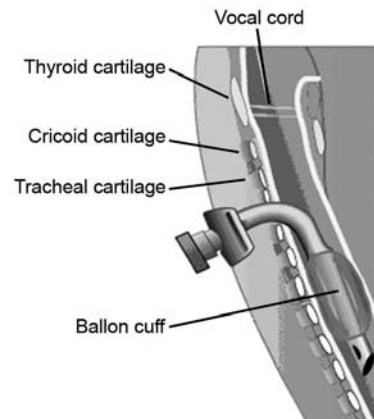
Cricothyroidotomy/Cricothyrotomy is incision through the skin and cricothyroid membrane for the relief of respiratory obstructions. This is done prior to or in place of tracheostomy in case of emergency respiratory obstruction.

B. Bleeding control is done by:

- Compression of blood vessels
- Dressing of the wound
- Ligation of the blood vessels or clamping.



(E) Tracheostomy tube in position



(F) Post operative view

Figs 20.11A to F: Tracheostomy procedure
(For color version see plate 6)

C. Consciousness restoration and circulation maintenance:

Consciousness maintenance depends on its cause-

- Intracranial injury
- Hemorrhage shock
- Neurogenic shock.

2. Maintenance of function is done by: Following the basic principles of fracture management, basic reduction and occlusal maintenance.

3. Esthetic Restoration is achieved by plastic surgeries and other esthetic surgeries.

PRINCIPLES OF FRACTURE MANAGEMENT

1. Reduction
2. Immobilization and Fixation

The principle/method for the treatment of facial fracture to be followed in a specific case depends on:

- Fracture pattern
- Skill of operator
- Resources available
- General medical conditions of patient
- Presence of other injuries
- Degree of infection
- Associated soft tissue injury and loss.

1. **Reduction:**

It is bringing of the fractured fragments close to each other and in the correct anatomic and functional position. This can be done either by a closed/nonsurgical way or by a open/surgical way as the condition demands.

i. Closed/Non surgical reduction:

Mostly done by occlusal maintenance. The wear facets acts as an important clue for the occlusion anterior or lateral open bite. Temporary reduction is done in some cases to postpone the surgical procedure till the general health of the patient improves. Non- surgical reduction is done either by using specially designed forceps- Rowe's disimpaction forceps, in a rocking and rotating movement or by using elastic tractional forces or even manually.

ii. Open/Surgical reduction:

This is done in cases where closed reduction is not effective. Various surgical approaches are followed to reach the site of fracture.

Incisions for surgical exposure of maxilla:

- Vestibular
- Palatal
- Mid - face degloving procedure.

Incisions for surgical exposure of orbito-zygomatic complex (Fig. 20.12):

- Supero-lateral orbital rim:
 - Lateral eyebrow
 - Supratarsal fold
 - Extended preauricular
 - Coronal

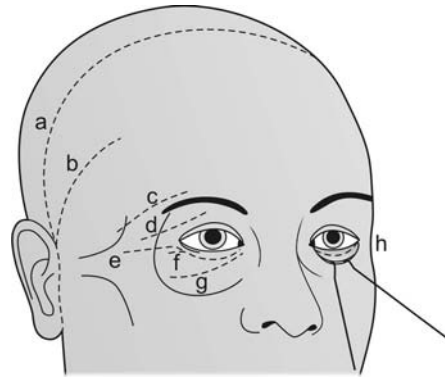


Fig. 20.12: Incisions for exposing orbito-zygomatic complex: (a) Coronal, (b) Preauricular, (c) Lateral brow, (d) Supratarsal fold, (e) lateral canthus, (f) Subciliary, (g) Midtarsal, (h) Transconjunctiva

ii. Lateral orbital rim and body of zygoma:

- Lateral canthus
- Extended preauricular
- Coronal.

iii. Inferior orbital rim and orbital floor:

- Midtarsal
- Subciliary
- Transconjunctival

Incisions for surgical exposure of medial orbital wall, naso-ethmoidal complex and frontal bone:

- Local
- Coronal

Incisions for surgical exposure of mandible:

- Submandibular approach - Risdon's
- Postramal approach - Hind's
- Postauricular approach
- Endural approach
- Preauricular approach:
 - Digman's
 - Blair's
 - Thoma's
 - Popowich's modification of Al-Kayat and Bramley's
- Hemicoronal approach

- vii. Intraoral approach – degloving incision.
(For details see the chapter on tempero-mandibular joint)

Before reduction any teeth present in the fracture line may require extraction. The indications for extraction are;

- Longitudinal fracture involving root.
- Dislocation/subluxation of teeth from socket.
- Presence of periapical infection.
- Infected fracture line
- Acute pericoronitis
- Functionless teeth (third molar)
- Advanced caries
- Advanced periodontal disease
- Teeth in untreated fracture from more than 3 days.

Reduction should be done from outside to inside. The outer frame bones are reduced first and the inner nasal bones at the last (Fig. 20.13).

2. Immobilization:

Immobilization is the process of fixation or making the fractured fragments stay in their reduced, anatomical and functional position until healing occurs.

Various methods of immobilization are:

1. Osteosynthesis without intermaxillary fixation:
 - a. Non-compression plates
 - b. Compression plates

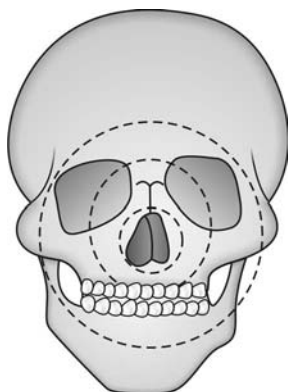


Fig. 20.13: Frame of fracture reduction
(Outer to inner)

- c. Miniplates
- d. Lag screws
- e. Resorbable plates and screws
2. Intermaxillary fixation:
 - a. Bonded brackets
 - b. Dental wiring
 - i. direct
 - ii. eyelet
 - c. Arch bars (Winter, Jelenko, Erich type)
 - d. Cap splints (used in children).
3. Intermaxillary fixation with osteosynthesis:
 - a. Transosseous wiring
 - b. Circumferential wiring and internal suspension
 - c. External fixation
 - d. Transfixation with Kirschner wires.

1. *Osteosynthesis without intermaxillary fixation:*

Most fractures can be fixed using either form of plates, whereas lag screws can be used in oblique fracture fixation. Semirigid plates are less effective as a small gap exists between the bone ends and the primary callus formation is limited whereas in compression plates full strength bone healing takes place but precise reduction is different to achieve using compression plates, as compression plates work on the principle of fracture treatment of weight bearing long bones. Hence non-compression miniplates are the best and mostly used for treatment of jaw fractures.

Miniplates

Earlier used miniplates were cobalt - chronic alloy metacarpal plates of upto 1 inch in length, for fixing the jaw bone fractures. In recent times stainless steel and titanium are used for the construction of these miniplates. Miniplates can be of compression and non-compression type, of which the non-compression type is the best used (Figs 20.14A and B).

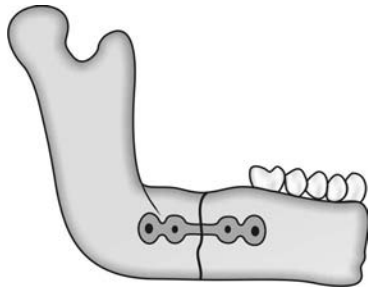


Fig. 20.14A: Miniplates

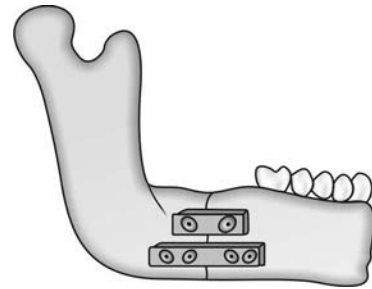


Fig. 20.14B: Compression plates

Armamentarium needed for use of mini-plates:

- a. Screw driver
- b. Plate bending lever
- c. Plate bending plier
- d. Plate modeling pliers
- e. Cutting shears
- f. Screw holding forceps
- g. Plates of assorted sizes stored in a rack

Technique for use of Miniplates

- Intraoral, extraoral or combination approaches are done for the insertion of plates.
- Monoaxial and precise holes are drilled slowly onto the either side
- Plates are adapted along the ideal osteosynthesis line by bending with modeling pliers.
- Atleast two screws are fixed on either side which holds the plate firmly in position.

Indications of use of Plates

1. In cases where intermaxillary wiring is contraindicated
2. In patients who desire to reduce the period of healing.
3. Complicated fracture with loss of bone segment or where non-union or malunion has occurred
4. Fractures associated with closed head injuries

Contraindications of use of Plates

1. Grossly displaced, extensively comminuted and heavily contaminated fractures.
2. Presence of pathological abnormalities in bone.
3. Patients in mixed dentition period.

Lag Screws:- It is effective only in certain oblique fractures of mandible. Two or more holes are drilled in the outer cortex whose diameter are slightly larger than the threaded part of the screw. The screws are tightened such that the head of the screw engages the outer plate and thus compressing the fractured segments (Fig. 20.15).

Resorbable plates and screws:- Materials like polylactides are used to construct plates which are strong and rigid, and can be absorbed within the body after causing complete bone healing. These are mostly used in orthognathic and craniofacial surgeries.

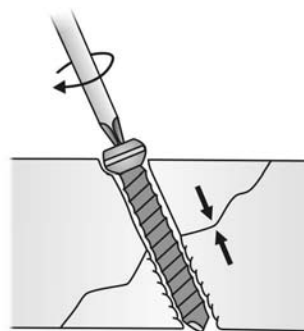


Fig. 20.15: Lag screw

2. Intermaxillary fixation

It is a process of immobilizing the jaw in case of dentulous patients. Mostly used along with some form of direct osteosynthesis.

Silver cap splints and bonded orthodontic brackets were earlier used for intermaxillary fixation whereas these days other methods are more common.

Dental Wiring

0.45 mm, soft stainless steel wire is best used after stretching by about 10 percent for various dental wiring procedures (Fig. 20.16).

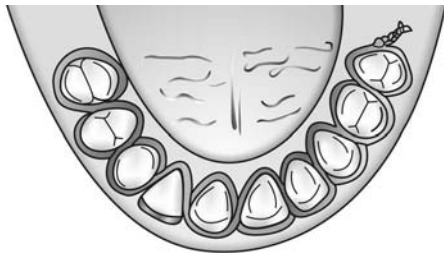


Fig. 20.16: Dental wiring

- i. Direct wiring:-15 cm long wire is twisted around a suitable tooth and then the free ends are twisted together to produce 7.5-10 cm long plated wire. Similarly wires attached on other teeth which are further twisted together to achieve a temporary intermaxillary fixations (Fig. 20.17). In this method it is difficult to release the

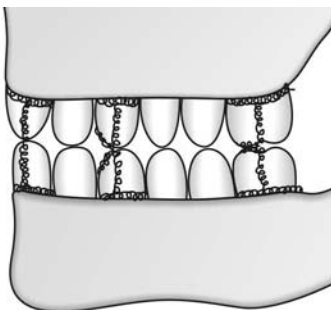


Fig. 20.17: Direct wiring

intermaxillary connection without stripping off all the fixations. Hence eyelet wiring is preferred.

- ii. Interdental eyelet wiring (Gilmer's wiring):- 20-25 cm long wire is grasped with two artery forceps on either side and two turns are given in the middle of the wire around a 3 mm diameter round bar—thus making an eyelet with two free ends. The eyelet is fitted by pushing between two teeth and the free end is held passing through the lingual and palatal aspect of the teeth before twisting the free ends. Similarly five eyelets are placed in the upper and five in the lower jaw. The free ends of the eyelet are attached to each other in a cross-branching manner thus achieving a strong fixation (Fig. 20.18). In this method a fracture can be tested by removing only the tied wires.

Arch Bars: This is the most versatile method and is useful in cases where there are insufficient suitable number of teeth for eyelet wiring. Various prefabricated arch bars - winter, Jelenko, Erich or metal bar bend to confirm the dental arch is cut to the required length and is held attached to the dental arch by a 0.45 mm soft stainless steel wire around the teeth. This method thus helps in intermaxillary fixation (Figs 20.19 and 20.20).

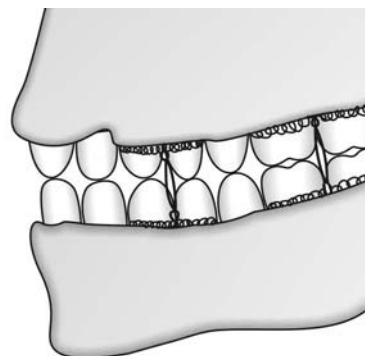


Fig. 20.18: Eyelet wiring

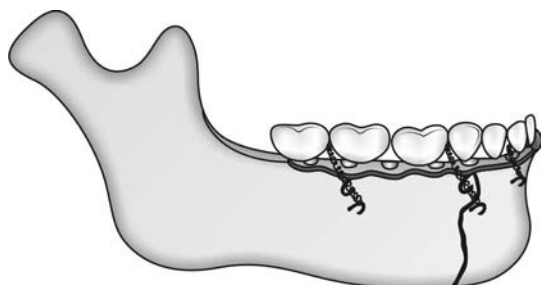


Fig. 20.19: Intramaxillary fixation

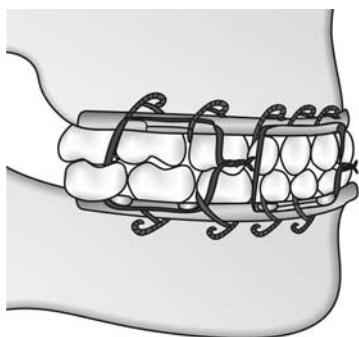


Fig. 20.20: Arch bar wiring

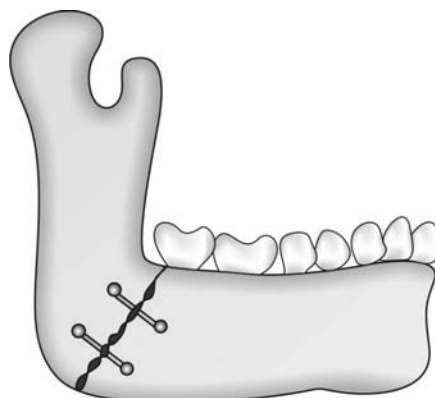


Fig. 20.21: Transosseous wiring

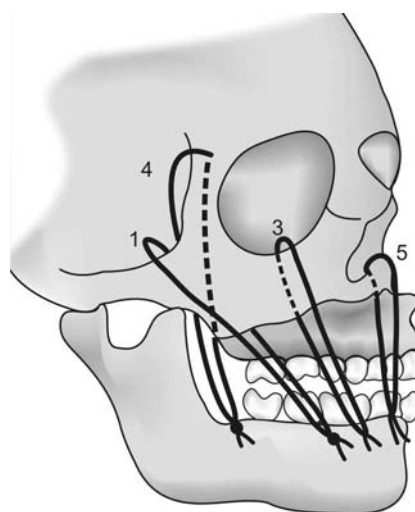


Fig. 20.22: Internal suspension

3. Intermaxillary fixation with osteosynthesis: Transosseous wiring:

In this method holes are drilled in the bone ends either side of the fracture line after which a length of 0.45 mm soft stainless steel wire is passed through the hole and across the fracture. The free ends are twisted tightly and the twisted ends are tucked into the nearest hole (Fig. 20.21).

Circumferential wiring and internal suspension:
Internal suspension works on the principle that we use some stable portion of the facial skeleton above the line of fracture as an anchorage point for the suspension wires, which are connected to circumferential wiring in lower canine region or a lower arch bar (therefore, the fractured maxilla is sandwiched between mandible and base of skull) (Fig. 20.22).

The various suspensions used are:

1. Circumzygomatic suspension
2. Zygomatico-mandibular suspension

3. Inferior orbital border-mandibular suspension.
4. Fronto-mandibular suspension.
5. Piriform fossa-mandibular suspension.

External fixation: Its principle is that rigid rods and universal joints are used to link the reduced maxilla to fixed part on frontal bone or cranium thus immobilizing them.

Indications for external fixation:

1. In case of infected fracture line
2. In case of extensively comminuted fracture

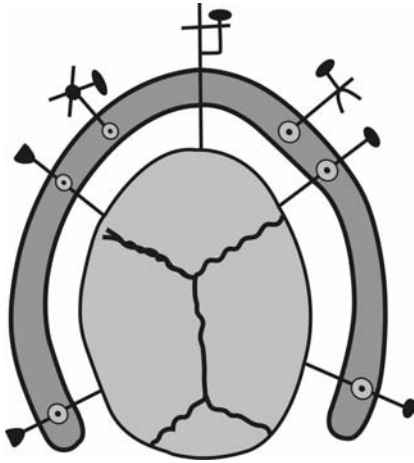


Fig. 20.23: Halo frame

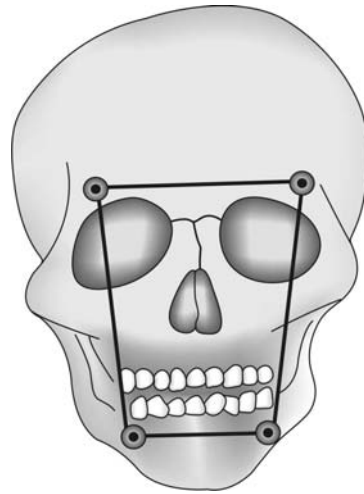


Fig. 20.24: Box-frame

3. In case of pathological fracture with large amount of bone loss
4. In case of bimaxillary fractures.

Some of the systems used are:

- i. Halo frame/plaster head caps: It is a frame that encircles the head and attaches to skull by 4 pointed screw pins (Fig. 20.23).
- ii. Supraorbital pins: Here support is achieved from 2 bone pins inserted into the supraorbital ridge.
- iii. Box-frame: This is an extension of the supraorbital pin. Here 2 more pins (total 4 in no) are inserted into the mandibular region (Fig. 20.24).
- iv. Adhesive plaster: This is placed under the chin and carried over the vertex so that adequate support to the mandible can be provided.
- v. Barrel bandage: It is applied two or three times around the vertex and the lower jaw. This bandage is wrapped around the forehead and back of the head and retained with the help of safety pin or adhesive plaster.
- vi. Elastic chin bandage is an effective and comfortable form of bandage
- vii. Four- tailed bandage: it helps to support fractured mandible.

TREATMENT OF EDENTULOUS PATIENTS

In edentulous patients the procedure of reduction and immobilization is the same except for the fact that generally these patients have poor medical conditions so surgical procedures should be avoided or done under special care. Because of the absence of teeth intermaxillary fixation is not possible so the various methods of immobilization followed are:-

1. Direct osteosynthesis
 - a. Bone plates
 - b. Transosseous wiring
 - c. Circumferential wiring
 - d. Tranfixation with Kirschner wires.
 - e. Fixation using cortico cancellous bone grafts.
2. Indirect external skeletal fixation
3. Using gunning splints either alone or in combination with other methods.

Gunning Splint

Gunning hand introduced splint for dentulous mouths for fractured mandible treatment. This is modified and used for treatment of fractured edentulous mandible.

It is a modified denture with bite blocks in molar region and space in anterior for feeding.

Immobilization is achieved by using gunning splint by:

- i. In completely edentulous patient, upper splint is attached to maxilla by peralveolar wiring and lower splint is attached to mandible body by circumferential wiring.
- ii. In single edentulous patients, fixation is done by fixing splints to the specific jaw and then intermaxillary fixation.

This splint is used mainly for treating simple mandibular fracture in edentulous patient by operators with less experience.

Limited use of this splint is because of:

- i. Food stagnation is there, therefore smells foul.
- ii. Candida induced stomatitis is common.
- iii. Poor control over mobile fracture especially when mandible is very thin.

SPECIFIC FRACTURES OF DENTOFACIAL REGION

Dento-Alveolar Fractures

These are the injuries in which avulsion, subluxation or fracture of teeth occurs in association with the fracture of the alveolus. The treatment of such fracture requires immediate and special care so as to relieve the patient of the pain and to preserve the dentition. Soft tissues like upper lip and tongue laceration should be taken care of. Avulsed tooth is treated by vertical splinting of one or more teeth.

Zygomatic Complex Fractures

Classification

1. Fracture of body of zygomatic complex involving the orbit:
 - i. Minimal or no displacement
 - ii. Inward and downward displacement (Fig. 20.25)



Fig. 20.25: Inward and downward

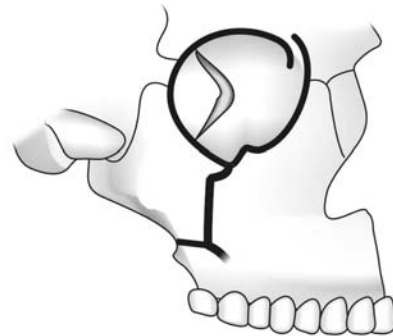


Fig. 20.26: Inward and posteriorly

- iii. Inward and posteriorly displacement (Fig. 20.26)
- iv. Outward displacement (Fig. 20.27)
- v. Comminution of the complex as a whole (Fig. 20.28)
2. Fracture of zygomatic arch alone- not involving the orbit (Fig. 20.29).
 - i. Minimal or no displacement
 - ii. 'V' type of fracture
 - iii. Comminuted fracture.

Clinical Features

- Flattening of cheek (seen immediately after fracture or after edema has subsided)

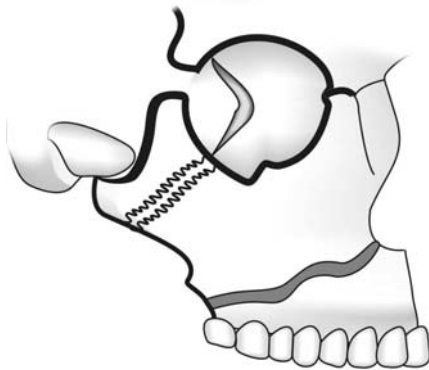


Fig. 20.27: Outward

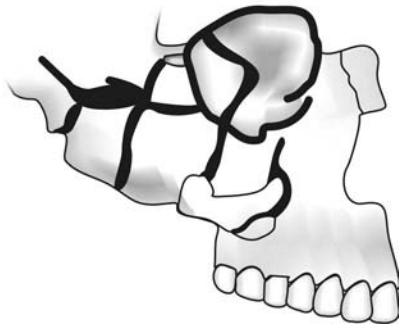


Fig. 20.28: Comminution

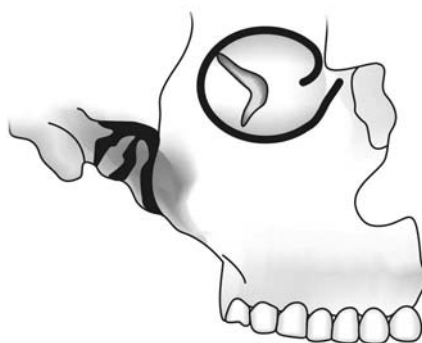


Fig. 20.29: Zygomatic arch alone

- Swelling of cheek
- Anesthesia of cheek, (because of damage to anterior, middle and posterior superior

alveolar nerves), temple (because of damage to infraorbital and zygomatic nerve), upper teeth and gingiva.

- Periorbital hematoma
- Subconjunctival hemorrhage
- Tenderness over orbital rim and fronto-zygomatic suture
- Step deformation of infraorbital margin
- Separation of frontozygomatic suture
- Ecchymosis and tenderness intraorally over zygomatic buttress.
- Limitation of ocular movement
- Diplopia
- Enophthalmos
- Lowering of the pupil level
- Epistaxis
- Limitation of mandibular movement (because of impingement of the coronoid process)
- Possible gagging of back teeth on injured side
- If only zygomatic arch is fractured then the main features are:
 - Limited mandibular movement
 - Depression of cheek and edema.
- Radiographically; zygomatic fracture is diagnosis with the help of occipitontental projection.

Treatment

In cases of minimal fracture of zygoma and in cases where patient is very elderly and has more postoperative risks, open reduction or any surgical procedures to treat zygoma fracture is contraindicated.

Indication for zygoma fracture reduction:

1. To restore normal contour of face (due to cosmetic reasons and for establishing facial skeletal protection of orbit)
2. To correct diplopia
3. To remove interference in mandibular movement
4. To decompress nerves.

Reduction

Many zygomatic complex fractures are stable after reduction and does not need any fixation, e.g.: mesial/lateral displacement of zygoma along vertical axis without separation of frontozygomatic suture.

Various methods of reduction are:

- i. *Temporal Approach (Gille's Approach)*: Principles of Gille's Approach: Zygomatic arch is covered by temporal fascia in superior surface and has temporal muscles attached beneath. Thus if an incision is made along the hairline and through the temporal fascia, the instrument (Rowe's zygomatic elevator) can pass down till the temporal muscle beneath the zygomatic arch, thus enabling the zygomatic bone to be elevated into correct position (Figs 20.30 and 20.31).

Procedure

An oblique 2 cm incision is made at the hairline between the bifurcations of the superficial temporal vessels, the temporal fascia is exposed and using a Rowe's/Bristow's elevator the zygomatic bone is brought back to position.

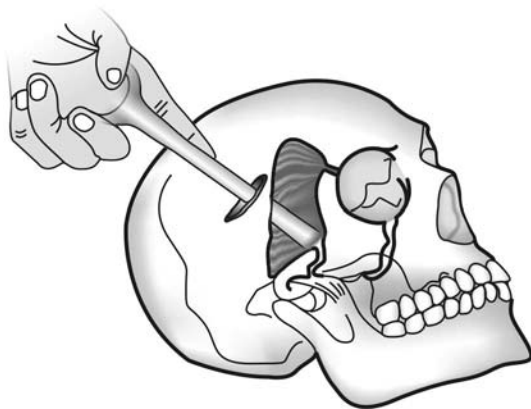


Fig. 20.30: Gille's approach

- ii. *Percutaneous Approach*: Here many hook ended instrument are used to reduce zygomatic bone fracture in cases where there is medial or lateral displacement with no separation in frontozygomatic suture. There is a single fine suture and thus the wound is almost invisible.
- iii. *Intraoral Approach*: This procedure is not widely practiced. In this approach incision is made at the upper buccal sulcus behind zygomatic buttress and curved elevator is passed to engage deeper surface of zygomatic bone, thus reducing it.

Fixation

Fixation can be achieved in following ways:

- i. *Temporal support*: It is done as an alternative to open reduction when the reduced zygomatic complex is unstable. Materials used in this procedure are:
 - Antral packs
 - Balloon catheters in antrum
- ii. *Direct fixation*:
 - a. *Transosseous wiring* (of frontozygomatic suture): It is the best method used if plates are not available. Holes are drilled in the



Fig. 20.31: Clinical view of the procedure of Gille's approach for zygomatic complex fracture reduction

- zygomatic process of frontal bone and frontal process of zygomatic bone. Stainless steel wire is passed through the holes and twisted. To increase stability figure of '8' wire is used.
- b. Bone plates: This is the best used method, especially for unstable fracture. Materials available are:-
- Vitallium miniplates
 - Stainless steel plates
 - Titanium plates (relatively more biocompatible)
 - Microplates
 - Mesh and special grid design plates
 - Resorbable materials
- iii. Indirect Fixation: In this method, the zygomatic bone is fixed indirectly to other parts of facial skeleton while healing takes place. This method is of limited use in case of unstable fracture. Materials used are:
- Rigid rods (used extraorally)
 - Transantral internal pins.

Nasoethmoidal Fractures

Features

- Fracture of naso-ethmoidal complex may involve the nasal, frontal, ethmoidal, frontal process of maxilla, lachrymal bones and septal and vomer.
- Brushing of skin over nasal bone
- Laceration of skin of bridge of nose
- Bilateral medial orbital ecchymosis
- Epistaxis
- Deformity of nose
- Cripitus of bones of nasal complex
- Unilateral or bilateral telecanthus
- Airway obstruction
- Septal laceration and hematoma
- Cerebrospinal rhinorrhea
- Septal deviation.

Treatment

Treatment is aimed at achieving proper shape of nose and maintaining the proper functional nasal passage.

In most of the nasal fractures, there is a slight fracture of the nasal bone and closed reduction using Ash's septal forceps and Walsham's forcep. Only in severe cases of naso-ethmoidal fractures, open reduction is done. Immobilization is rarely required, only in case where complete displacement is there. Immobilization is achieved by using intraoral or extranasal splintage.

Lefort - I Fracture

(Subzygomatic fracture, low level fracture, horizontal fracture or Guerin's fracture)

Here the fracture is such that the body of maxilla is separated from the base of skull above the level of palate and below the attachment of zygomatic process. The fracture line extends backwards from lateral margin of the anterior nasal aperture below zygomatic buttress to cross the lower third of pterygoid plate (Fig. 20.32 and 20.33).



Fig. 20.32: Lefort-I fracture line
(For color version see plate 7)

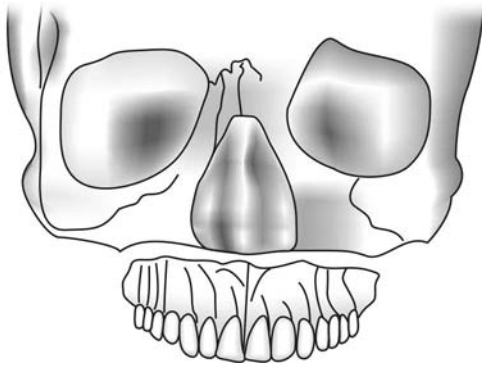


Fig. 20.33: Lefort-I fracture

Features

- Swelling and edema of lower part of face.
- Ecchymosis of lingual and labial vestibule
- Mobility of the upper dentoalveolar portion- "Floating jaw".
- Involvement of the teeth, lip and cheek may be seen.
- Occlusion derangement may/may not be there.
- On percussion of the maxilla at the molar and premolar region - a characteristic "Cracked Cup" or "Pot" sound is heard.
- Impacted or "Telescopic fracture" may be there. (the displaced fragment, moves upwards and gets locked).
- Bilateral epistaxis or nasal bleeding is seen.
- Ecchymosis in region of greater palatine foramen- Guerin's sign.

Lefort - II Fracture

(Pyramidal fracture, subzygomatic fracture, vertical fracture):

It is a vertical fracture extends upwards to the nasal and ethmoid bones, usually through maxillary sinus and one malar bone is involved.

The fracture line extends from midline of nasal bone down either side crossing the frontal process of the maxilla into the medial wall of each orbit. Then the fracture extends down-

wards and backwards across the lateral wall of the antrum below the zygomatico- maxillary suture and divides the pterygoid plate about half way (Figs 20.34 and 20.35).

Features

- Gross edema of middle third of face - "Ballooning of face" or "moon face".
- Bilateral circumorbital edema and ecchymosis "Black eye".
- Bilateral subconjunctival hemorrhage
- "Flat face" - depressed nose.



Fig. 20.34: Lefort-II fracture line
(For color version see plate 7)

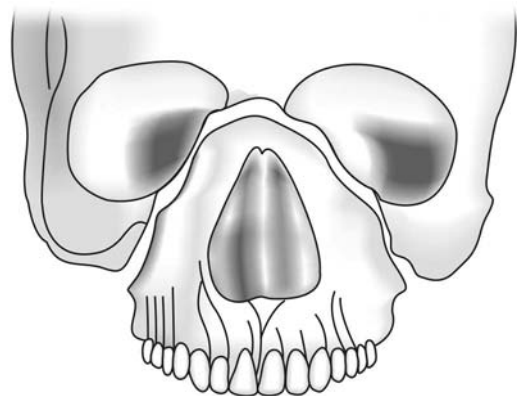


Fig. 20.35: Lefort-II fracture

- Anterior open bite and other occlusal dearrangement
- Bilateral epistaxis (bleeding from nose)
- Difficulty in mastication and speech
- Surgical emphysema
- CSF rhinnorea
- Step deformation at the infraorbital margin felt on palpation
- Anesthesia and paresthesia of cheek due to involvement of infraorbital foramina.
- Airway obstruction caused due to the impinging of the displaced fragments in the dorsum of tongue
- Radiographic diagnosis is difficult due to overlapping of the fragments.

Lefort - III Fracture

(High level fracture, Transverse fracture, cranio-facial separation)

It is a transverse fracture where there is complete separation of midface at level of naso-orbital-ethmoidal complex (NOE-complex) and zygomaticofacial suture area. Fracture also extends through orbit bilaterally. The fracture line extends across the orbit through the base of nose and ethmoidal region to the zygomatic arch (Figs 20.36 and 20.37).

Features

- Features are similar to those seen in lefort II fracture but are of more severe and intense nature.
- Gross edema of middle face (ballooning)
- Bilateral circumorbital ecchymosis and edema (prevents opening of eye)
- Bilateral subconjunctival hemorrhage.
- "Dish face" - central portion of the face is dished in
- Spooned out appearance in nasal area (because of fractured and posterior dislocation of maxilla)
- CSF rhinorrhea and orbital signs indicates cranial fracture and neurologic involvement, generally if one orbit is involved then 50



Fig. 20.36: Lefort-III fracture line
(For color version see plate 7)

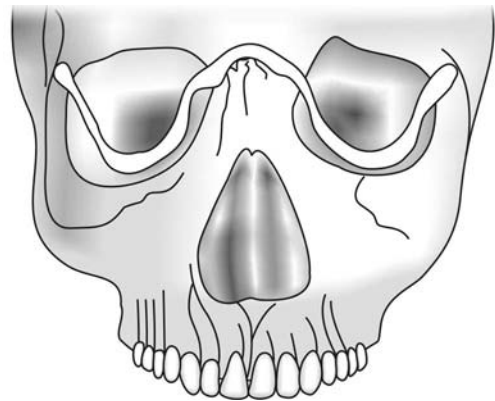


Fig. 20.37: Lefort-III fracture line

- percent chance of death, if two orbits are involved then 95 percent chance of death.
- Bleeding from ears and nose (Epistaxis)
- On palpation, bony step felt in infraorbital area
- CSF leak (neurologic involvement)

General Features in Lefort Fractures

- Airway obstruction: Excess bleeding, foreign body obstruction (tooth, denture) can cause airway obstruction. It occurs even when soft palate and tongue are pushed back.



Fig. 20.38: Clinical view of a patient with LeFort facial fracture. Epistaxis, CSF Rhinorrhea, facial edema, circumorbital ecchymosis, subconjunctival hemorrhage, facial disfigurement, orbital sign, etc are seen (For color version see plate 8)

- ii. Epistaxis: Bleeding from nose.
- iii. CSF Rhinorrhea: It is seen mainly in LeFort II and III fracture, due to dural tear associated with fracture of cribriform plate of ethmoid. It generally gets arrested in few days either spontaneously or after reduction and fixation of fracture. It may lead to meningitis, so needs prophylactic antibiotics and neurosurgeon care.
Diagnosed by: (different to detect immediately as gets mixed with blood)
 - Tran line pattern seen on face
 - Halo effect on pillow and sheet (It appears because of clear CSF spreading beyond clotted blood component)
 - In order to distinguish from mucous flow, CSF does not starch handkerchief on drying.
 - It can also be diagnosed by:
 - Test for protein and glucose
 - C.T scan
 - Intracranial administration of radioisotope and detection in nasopharynx and stomach
 - MRI is the confirmatory test.
- iv. Facial edema: Here ballooning of the face takes place and in severe cases, eyes cannot be opened.
- v. Emphysema: Air can be ingested in soft tissue and specially due to tear in periosteum and sinus lining and is felt as crepitus on palpation.
- vi. Circumorbital ecchymosis (Black eye)
- vii. Subconjunctival hemorrhage
- viii. Occlusal disturbance (anterior open bite and premature contact of molars are present if fracture involves dentition).
- ix. Facial disfigurement: Elongation of face, saddle and flat nose, dish-shaped face and flattened cheek is seen.
- x. Abnormal opening of mouth: It occurs due to downward displacement of fractured middle third or due to zygomatic bone fracture.
- xi. Orbital symptoms: These include limited opening of eye, enophthalmos, diplopia, blindness or decreased vision.
- xii. Oronasal opening: It is seen in case of palatal fracture.

Orbital Floor Fracture

It is also termed as blow out fractures. It can be classified as:

1. Impure blow out fracture (it includes LeFort II and III fractures or other fracture involving orbital floor).

2. Pure blow out fracture (it includes isolated orbital floor fracture) (Fig. 20.39).

It is called as "Blow-out fracture" as it describes mechanism of injury i.e. here there is posterior displacement of globe of eye by blunt trauma (deformation of infraorbital rim and rupture of orbital floor).

Features

- Periorbital ecchymosis
- Subconjunctival hemorrhage
- Diplopia (double vision or blurred vision). It is caused due to interference with the action of extraocular muscles causing oedema and haemorrhage in and around these muscles.

If there is actual damage to the extraocular muscles (not mere interference, then there is permanent diplopia) or to their nerve supply.

Types of Diplopia

- I. 1. Temporary (interference with the muscles)
2. Permanent (damage to muscles or nerve supply).

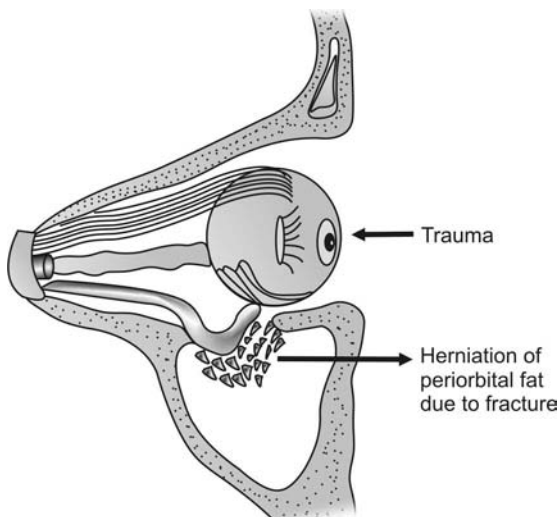


Fig. 20.39: Herniation of periorbital fat due to fracture

- II. 1. Mono-ocular (here diplopia is on one eye and severe ocular cause is present which needs attention)
2. Bin-ocular (diplopia affects both eyes because of zygomatic fracture).
 - Limited eye movement
 - Globe retraction
 - Enophthalmos (inward sinking of eye)
 - Emphysema of eyelid
 - Parasthesia in the area of distribution of infraorbital nerve
 - Herniation of orbital fats into maxillary sinus.

Diagnosis

- Clinical features (hanging drop appearance)
- Posteroanterior view (radiograph)
- Water's projection (radiograph)
- CT scan

Treatment

- Surgically exploring orbital floor and reconstructing orbital floor by sheet or bone graft is necessary
- Balloon support and ribbon gauge packing in sinus done for treating orbital floor fracture.

Mandibular Fractures

Features

The features of mandibular fracture are determined by the location of the fracture line and the intensity of the fracture.

I. Condylar Fracture

Classifications

- A. Row and Killey's classification, depending on the location.
 1. Extracapsular fracture/low condylar fracture/subcondylar fracture: Here, fracture runs from lowest point of sigmoid notch till upper part of ramus.

2. Intracapsular fracture/high condylar fracture: Here, fracture may or may not involve articulating surface but is above the neck of the mandible.
 3. Fracture involving ligament and capsule.
 4. Fracture involving adjacent bone.
- B. Mac Lennan's classification depending on the features:
1. No displacement: Crack fracture is seen but no alteration to relationship between condylar head and glenoid fossa or neck of condyle and ramus (Fig. 20.40).
 2. Deviation: Simple angulations between condylar neck and ramus (Fig. 20.41).
 3. Displacement: Overlap between condylar neck and ramus, condylar lie lateral to ramus (Fig. 20.42)
 4. Dislocation: Disruption between condylar head and glenoid fossa, condylar fragment pulled by lateral pterygoid muscle (Fig. 20.43).



Fig. 20.40: No displacement

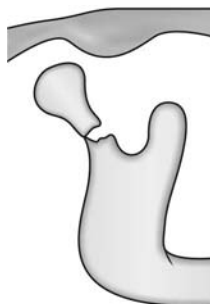


Fig. 20.41: Deviation

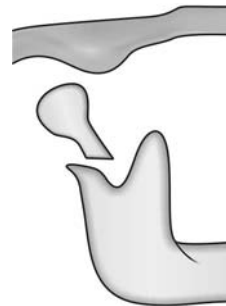


Fig. 20.42: Displacement

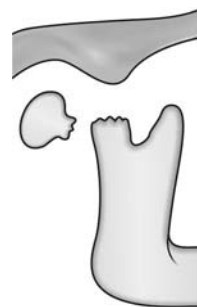


Fig. 20.43: Dislocation

Features

- Evidence of facial trauma seen.
- Localized pain and swelling TMJ
- Deviation of mandible upon opening towards the involved side in unilateral fracture.
- Posterior dental open bite on the contralateral side in unilateral fracture
- Limited opening of mouth
- Difficulty in lateral and forward movement of mandible
- Blood in external auditory canal (epistaxis)
- Shift of dental occlusion
- Pain on palpation over the fractured site
- Lack of condylar movement
- Anterior open bite in case of bilateral fractures
- CSF back through ear due to fracture of middle cranial fossa.
- Abnormal mandibular development and ankylosis of jaws is seen in cases where

treatment is delayed, especially in case of condylar fracture in growing children.

- Battle's sign- Hematoma is found surrounding a fractured condyle which may track downwards and backwards below the external auditory canal, which gives rise to ecchymosis of the skin just below the mastoid process (also seen in fracture of the base of the skull)

II. Coronoid Fracture

Coronoid fracture of the mandible is a very rare fracture.

Features

- Difficult to diagnose clinically
- Tenderness over anterior part of ramus
- Tell-tale haematoma
- Painful limited mandibular movement.

III. Ramus Fracture

Ramus fracture is also a rare fracture.

Features

- Swelling present intraorally and extraorally
- Ecchymosis present both intraorally and extraorally
- Tenderness over ramus
- Pain while mandibular movement
- Trismus

IV. Angle Fracture

Features

- Painful mandibular movement
- Trismus
- Swelling at angle and therefore facial asymmetry
- Step deformation behind last molar when seen intraorally
- Occlusal disturbances
- Adenotoma at angle of mandible

- Anesthesia and parasthesia of lower lip of fractured side.
- Tender on palpation near angle.
- Movement or crepitus at fractured site on palpation.
- In case of unfavorable fracture of angle of mandible the line of treatment is open reduction with miniplates and screws.

V. Body Fracture

(Molar and premolar region)

Features

- Swelling at site
- Pain while movement
- Occlusal disturbance
- Intraoral hemorrhage
- Anesthesia and parasthesia in distribution of inferior alveolar nerve (lower lip).

VI. Parasymphysis and Symphysis Fracture

This type of fracture is usually associated with condylar fracture.

Features

- Loss of voluntary tongue control and airway obstruction.
- Disorientation of anterior mandible and adjacent soft tissues.

SPECIFIC FEATURES IN TREATMENT OF MANDIBULAR FRACTURE

- The treatment of mandibular fracture in children before puberty is generally of a conservative nature because of the rapidity of healing and adaptive potential of the bone and its contained dentition.
- In the very young with unerupted or very few deciduous teeth, use of an overall gunning splint for the lower jaw is recommended.

- Cap splint can be constructed for mixed dentition.
- When there are sufficient firm erupted deciduous and permanent teeth, eyelet wiring or arch bars can be used.
- Bone plates and pins are contraindicated in most cases of mandibular fractures in patients less than 10 years. Only in case of gross displacement of symphysis or angle fracture, the lower border may be wired.

COMPLICATIONS OF FRACTURE TREATMENT

1. During Treatment

- i. Infection: Seen more in diabetic patients or patients with reduced immunity, steroid therapy.
- ii. Nerve injury: Damage to inferior alveolar nerve or facial nerve leading to anesthesia of lower lip, face etc.
- iii. Displaced teeth and foreign body being aspirated.
- iv. Pulpitis, gingival and periodontal complications.

2. After Treatment

- i. Malunion:-
 - a. Dysarthrosis - Morphological changes in unreduced dislocated fragments leading to limited movement and pain.
 - b. Metaarthrosis - Anatomically altered but functionally accepted union leading to no severe symptoms.
 - c. Pseudoarthrosis - False joint leading to severe pain during movement. This is caused due to formation of cartilaginous tissues over fractured bone and with a cavity in between, containing clear fluid. This is notably seen in old fractures.
Causes of malunion:
 - Improper fixation
 - Early mobilization
 - Tissue entrapment

- ii. Delayed union: Caused of delayed union:
 - Infection
 - Old age
 - Nutritional deficiency
- iii. Nonunion (eburnation)
Caused of nonunion:
 - Infections
 - Improper immobilization
 - Inadequate approximation
 - Ultra thin, edentulous mandible
 - Excess loss of bone and soft tissue
 - Inadequate blood supply
 - Bony pathology like tumor
 - General systemic diseases
 - Sequestration of bone
 - Scar formation in the region.

FURTHER READING

1. Archer WH—Oral and maxillofacial Surgery, 5th ed, vol. 2.
2. Banks, Brown—Fracture of the facial skeleton.
3. David/Simpson—Craniofacial trauma.
4. Fonseca—Oral and maxillofacial trauma, Vol. 1 and Vol. 2, 3rd ed.
5. Geoffrey L Howe—Minor and Surgery, 3rd ed.
6. OmarAbubaker, Keneth Benson—Oral and Maxillofacial Surgery secrets, 2nd ed.
7. Peter Banks—Killey's fracture of the mandible, 4th ed.
8. Peterson, Ellis, Hupp, Tucker—Contemporary oral and maxillofacial Surgery, 4th ed, 2006.
9. Ranajit Sen—Fractures of the mandible.
10. RA Cawson—Essentials of Dental Surgery and Pathology, 5th ed.
11. Ward Booth, Eppley, Schmelzeisen—Maxillofacial trauma and esthetic facial reconstruction.
12. Ward Booth, Schendel, Hausamen—Maxillofacial Surgery, 2nd ed, Vol. 1 and Vol 2.

Appendix — 1

(Osteology)

OSTEOLOGY

Osteology is the study of bones. The skeleton of the head is called as the skull. The skull is made up of two parts - the calvaria is the upper part of the cranium which encloses the brain and the facial skeleton that includes the rest of the skull and include the mandible.

The skull consists of 22 bones and divided into:

i. The calvaria, composed of 8 bones, they are:

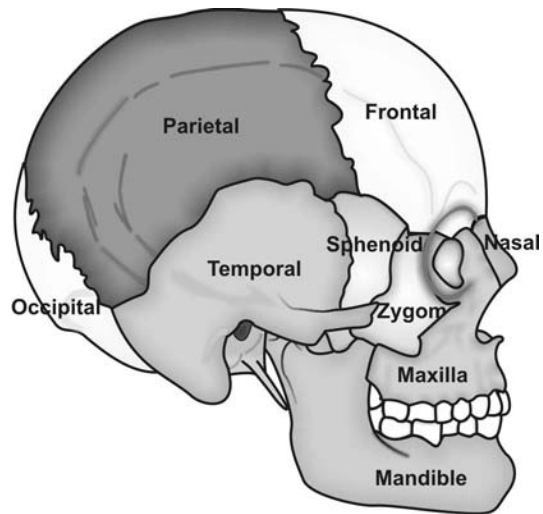
- | | |
|------------------|---------------------|
| i. <i>Paired</i> | ii. <i>Unpaired</i> |
| 1. Parietal | 1. Frontal |
| 2. Temporal | 2. Occipital |
| | 3. Sphenoid |
| | 4. Ethmoid |

ii. The facial skeleton is composed of 14 bones, they are:-

- | | |
|---------------------------|-----------------|
| <i>Paired</i> | <i>Unpaired</i> |
| 1. Maxilla | 1. Mandible |
| 2. Zygomatic | 2. Vomer. |
| 3. Nasal | |
| 4. Lacrimal | |
| 5. Palatine | |
| 6. Inferior nasal concha. | |

STUDY OF DIFFERENT ASPECTS OF THE SKULL

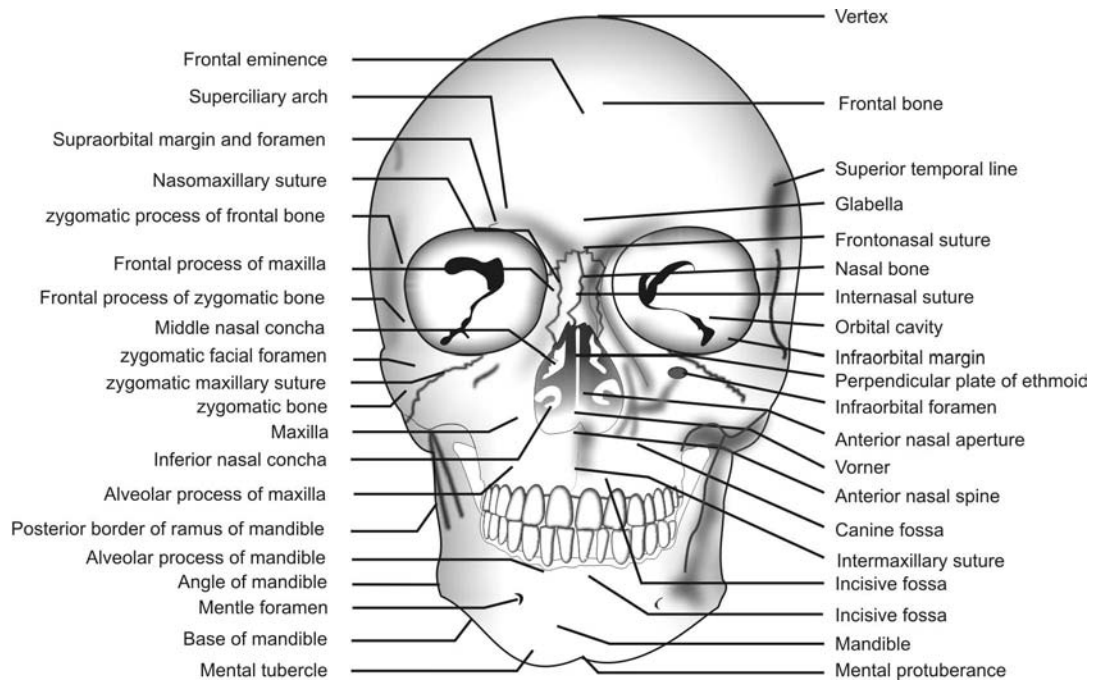
The skull is divided into five normas to aid in its study:



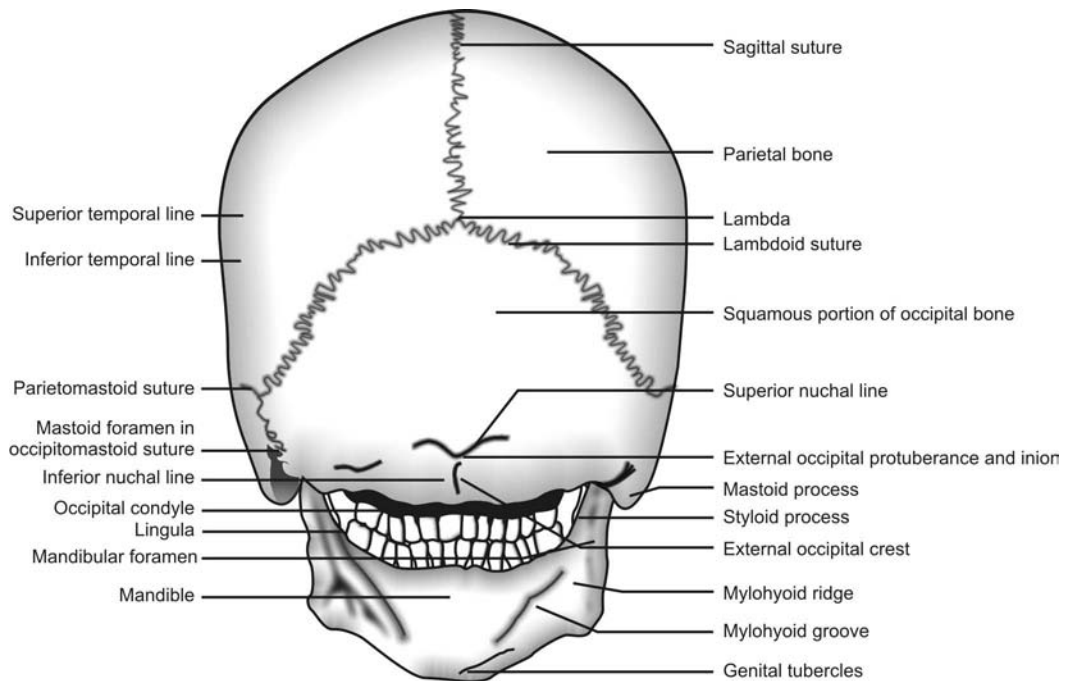
Bones of The Skull
(For color version see plate 8)

1. Norma frontalis
2. Norma occipitalis
3. Norma lateralis
4. Norma basalis
5. Norma verticalis

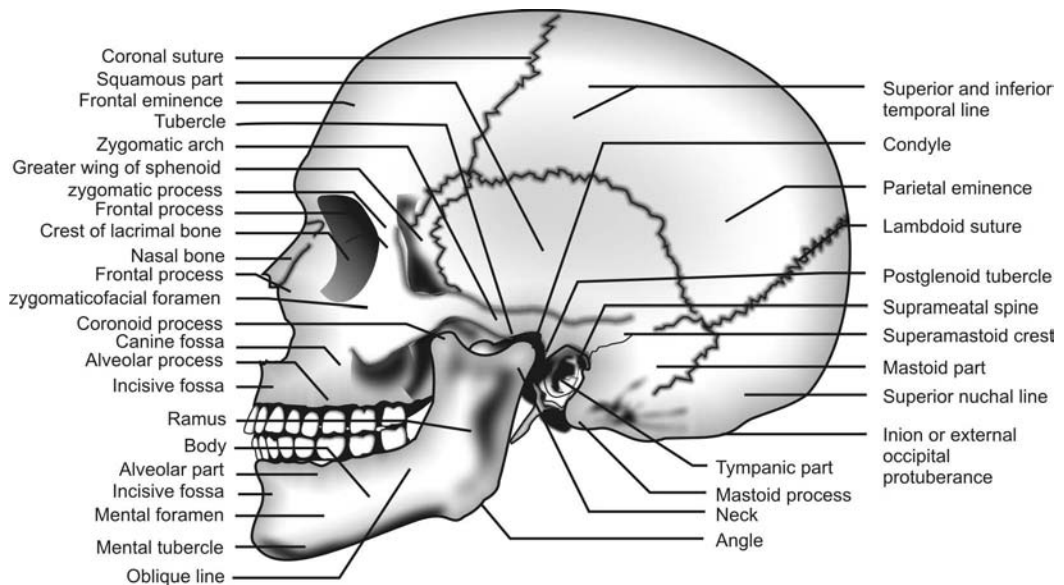
VARIOUS PARTS OF THE NORMAS



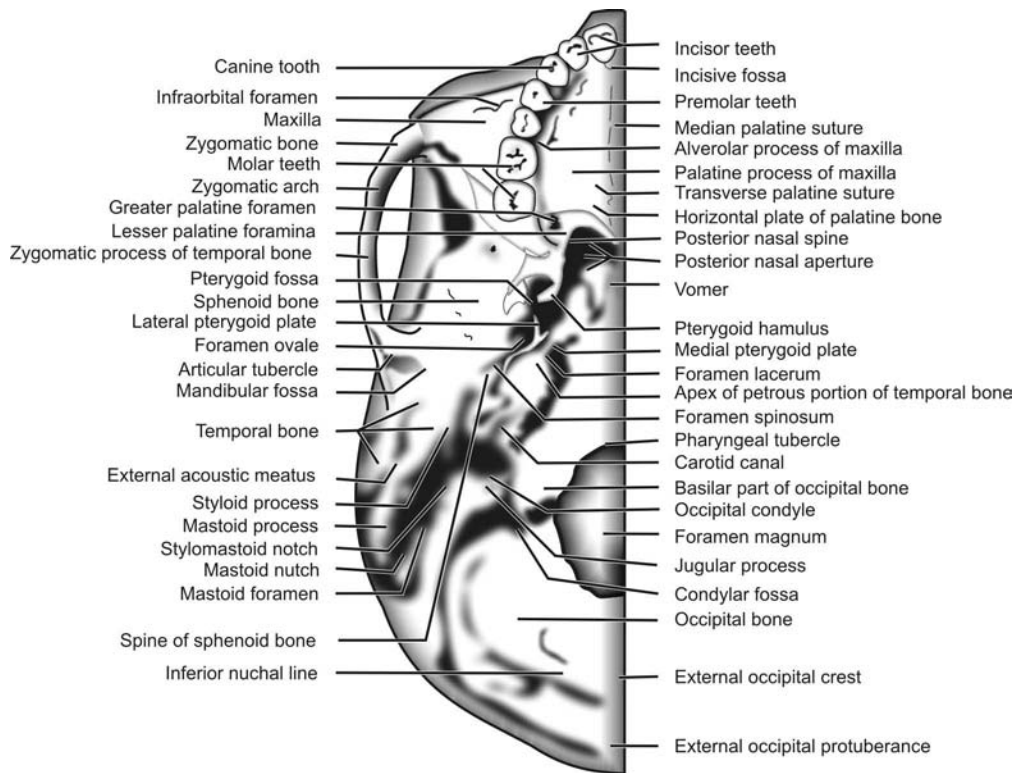
Norma frontalis



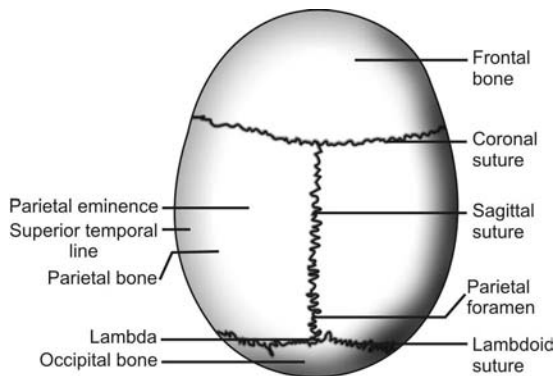
Norma occipitalis



Norma lateralis



Norma basalis



Norma verticalis

FORAMINA'S OF THE SKULL AND CONTENTS OF EACH

1. Superior orbital fissure
 - Oculomotor nerve
 - Trochlear nerve
 - Ophthalmic division of trigeminal nerve
 - Abducent nerve
 - Sympathetic fibres from cavernous plexus
 - Ophthalmic vein.
2. Inferior orbital fissure:
 - Infraorbital nerve
 - Infraorbital artery
 - Orbital branch of maxillary division of trigeminal nerve
 - Zygomatic branch of maxillary division of trigeminal nerve
3. Foramen ovale
 - Mandibular division of trigeminal nerve
 - Accessory meningeal artery
4. Foramen spinosum
 - Middle meningeal vessels
 - Meningeal branch of mandibular nerve.
5. Stylomastoid foramen
 - Facial nerve
 - Stylomastoid artery
6. Carotid canal
 - Internal carotid artery.
7. Jugular foramen
 - Posterior compartment: internal jugular vein
 - Middle compartment: glossopharyngeal, vagus and accessory nerves.
 - Anterior compartment: inferior petrosal sinus.
8. Foramen Lacerum
 - Internal carotid artery across cerebral surface of fibro cartilage.
9. Foramen Magnum
 - Spinal cord
 - Meningeal coverings
 - Spinal accessory nerve
 - Vertebral arteries
 - Anterior spinal artery
 - Posterior spinal arteries.
 - Ligaments.
10. Hypoglossal canal
 - Hypoglossal nerve.
11. Condylar canal
 - Emissary vein
12. Foramen rotundum
 - Maxillary division of trigeminal nerve.
13. Mandibular foramen
 - Inferior alveolar vein
 - Inferior alveolar artery
 - Inferior alveolar nerve.

DEVELOPMENT OF MANDIBLE

The mandible is the second bone (next to the clavicle) to ossify in the body. A greater part of the mandible ossifies in the membrane whereas the part that ossifies in the cartilage are the incisive part below the incisor teeth, the condylar, coronoid process and the upper half of the ramus above the level of mandibular foramen. The mandible starts ossifying at 6th week of intrauterine life in the mesenchymal sheath of the Meckel's cartilage.

Appendix — 2

(Case History)



A GENERAL CASE HISTORY FORMAT USED IN ORAL AND MAXILLOFACIAL SURGERY

Personal Details

Name - Address -
Age - Occupation -
Sex - Religion -
Chief Complaint -
History Of Present Illness -
Past Medical History -
Past Dental History -
Drug History -
Family History -
Personal History -

General Examination

Physical Examination: Examination of vital signs:
Nourishment- Blood pressure-
Built - Pulse -
Gait - Temperature -

Clinical Examination

Pedal oedema-
Clubbing -
Pallor -
Ecchymosis -
Cyanosis -
Jaundice -
Petechiae -
Any others -

Dental Examination

Extra- oral:
Lymph nodes -
TMJ findings -

Intra-oral:

Soft Tissue Examination

Gingival -
- Colour -
- Contour -
- Consistency -
- Shape -
- Size -
- Surface texture -
- Bleeding on probing -
- Position -
- Examination on pressure -

Hard Tissue Examination

Teeth present -
Missing teeth -
Carious teeth -
Filled teeth -
Root stumps -
Mobile teeth -
Tender on percussion -

Provisional Diagnosis

Investigation:-

- Radiological -
- Biochemical -
- Histopathological -

Final Diagnosis:-

Treatment Plan:-

Treatment Done:-

Drugs Prescribed:-

Appendix — 3

(Armamentarium)

ARMAMENTARIUM USED IN ORAL AND MAXILLOFACIAL SURGERY

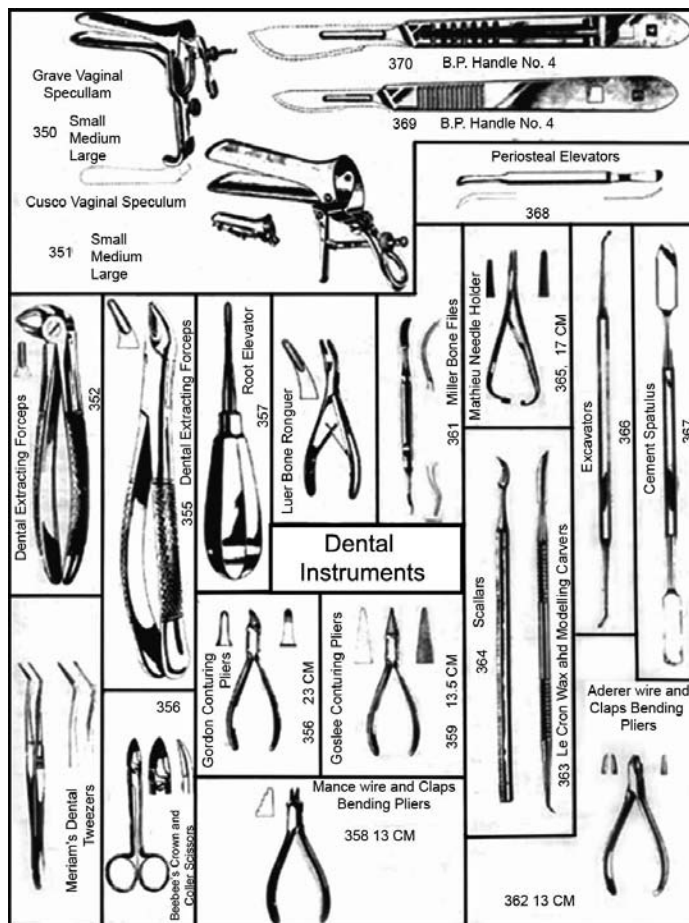
- I. Instrument for anesthesia, airway maintenance:
 - 1. Laryngoscope
 - 2. Endotracheal tube
 - 3. Cricothyrotomy set
 - 4. Tracheostomy set
- II. Instrument for gaining surgical asepsis:
 - 1. Cheateic forceps
 - 2. Swab holder
 - 3. Tower clip
- III. Instrument for gaining access:
 - 1. Scalpel
 - Blade handle
 - Blade
 - 2. Dissecting scissors
- IV. Instruments for reflection of mucoperiosteal flap:
 - 1. Periosteal elevator.
- V. Instruments for retraction:
 - 1. Langenback
 - 2. C-shaped
 - 3. Austin
 - 4. Cat's paw retractor
 - 5. Obwegessor's
 - 6. Skin hook
 - 7. Chin
 - 8. Alar
 - 9. Tongue depressor.
- VI. Instruments for suction:
 - 1. Suction tube
 - 2. Suction tip
- VII. Instruments for holding:
 - 1. Needle holder
 - 2. Hemostatic forceps
 - 3. Kocher's artery forceps
 - 4. Tissue holding forceps
 - a. Alli's tissue holding forceps
 - b. Adson's tissue holding forceps
- VIII. Instruments for bone removal:
 - 1. Bone rougeurs
 - 2. Chisel
 - 3. Osteotome
 - 4. Gigli's saw
 - 5. Bone file
 - 6. Hand piece and bur.
- IX. Instruments to hold the bone:
 - 1. Bone holding forceps
 - 2. Sequestrum holding forceps
- X. Instrument for wound debridement:
 - 1. Curette
 - 2. Bone scoop
 - 3. Listers sinus forcep
 - 4. Drains
- XI. Instrument for management of fracture osteotomies:
 - 1. Hayton Williams forceps
 - 2. Rowe's disimpaction forceps
 - 3. Walsham forceps
 - 4. Asche's forcep.
 - 5. Bone awl
 - 6. Rowe's zygomatic elevator
 - 7. Wire pusher
 - 8. Smith's bone spreader
 - 9. Nasal speculum.
- XII. Miscellaneous instrument:
 - 1. Mouth prop
 - 2. Mouth gag
 - 3. Foleys self retaining catheter
 - 4. Ryle's tube
 - 5. Jaw stretcher
 - 6. Trocar
 - 7. Surgical diathermy
 - 8. Cryosurgery
 - 9. Infant feeding tube



Old Days Dental Armamentarium



Modern Days Dental Armamentarium



Dental Armamentarium

Appendix — 4

(Facial Pain)

CLINICAL FEATURES OF SOME IMPORTANT LOCAL CONDITIONS CAUSING FACIAL PAIN

<i>Pain due to</i>	<i>Character of pain</i>	<i>Site of pain</i>	<i>Radiates into</i>	<i>Precipitating factors</i>	<i>Relieving factors</i>	<i>Timing</i>	<i>Other symptoms and signs</i>	<i>Progress if untreated</i>
1. Pulpal cases	Sharp and severe at first. Later sharp, severe and continuous.	Affected tooth and/or referred to another tooth or edentulous area in either jaw or same side of face.	Ear (lower teeth) and cheek, eye and temple (upper teeth)	Intra oral thermal and osmotic changes at first. Later, nil.	Withdrawal of stimulus (stage 1). Mild analgesics at first but analgesics gradually lose effect.	Occurs only stimulus applied (stage 1). Lasts 20-30 min after stimulus withdrawn (stage 2). Usually lasts longer than 30 min (stage 3)	Caries of crown of tooth. New restoration or crack in enamel.	May progress to acute periodontitis and abscess formation.
2. Acute Periodontitis	Dull at first. Later dull with acute exacerbations when tooth bitten upon.	Affected tooth.	-----	At first nil but later biting on tooth.	Biting on affected tooth in early stages only Analgesics	Continuous but worse at mealtimes.	Redness of overlying gum. Affected tooth 'high' to bite and periodontitis.	May progress to abscess formation.
3. Acute dental abscess	Dull, throbbing and severe with sharp exacerbations when involved tooth bitten upon or touched.	Affected tooth.	Ear (lower tooth), cheek, eye and temple (upper tooth).	Biting upon or touching involved touch.	Heat in early stages. Analgesics	Continuous worse at night and mealtimes. Prevents sleep.	When swelling appears after few hours pain is less intense although tooth is still acutely tender to touch. Tender lymph nodes and pitting edema.	Pus bruits into soft tissues and pain diminishes. Pus may discharge and lesion may become chronic.

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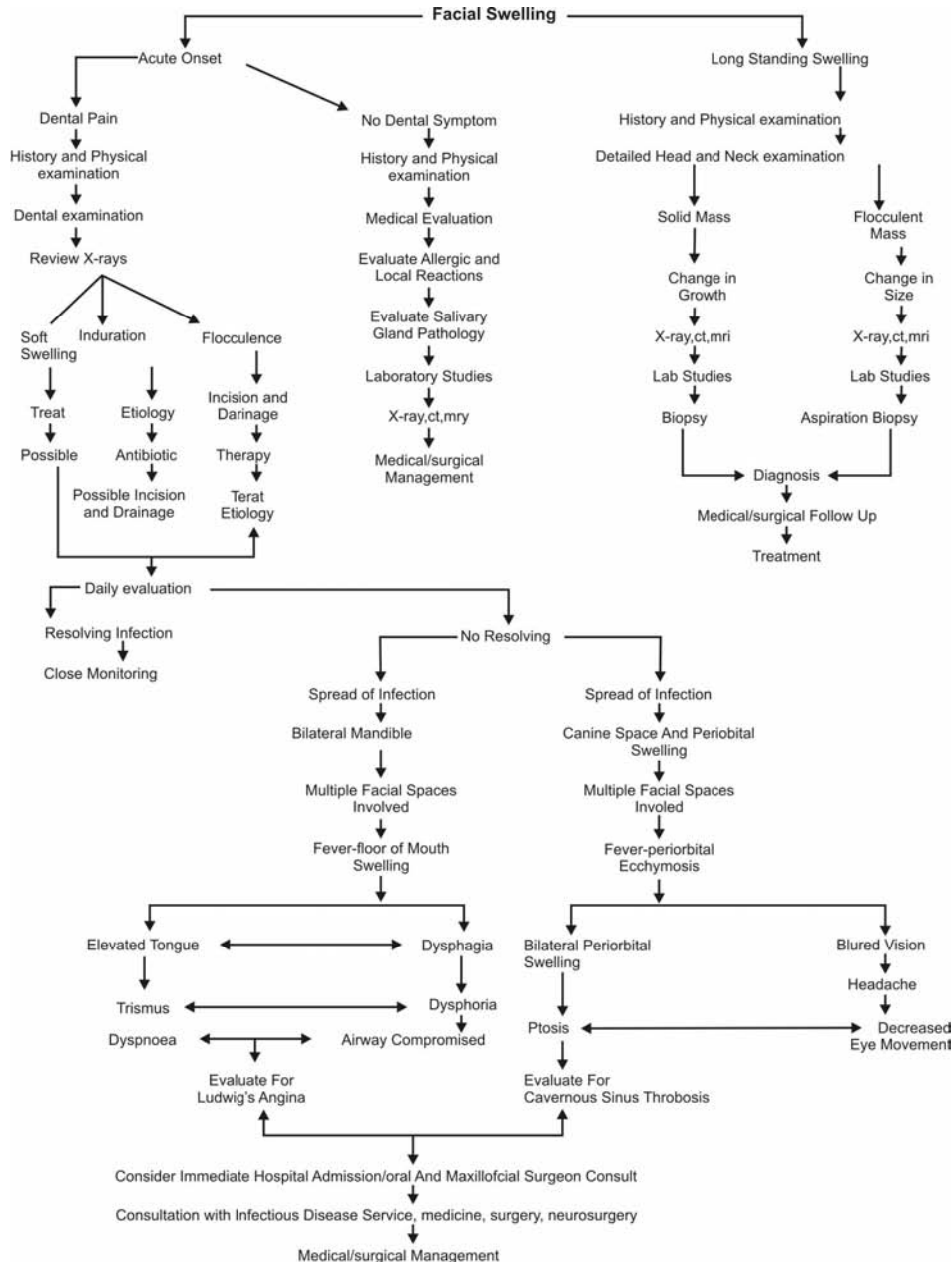
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<i>Pain due to</i>	<i>Character of pain</i>	<i>Site of pain</i>	<i>Radiates into</i>	<i>Precipitating factors</i>	<i>Relieving factors</i>	<i>Timing</i>	<i>Other symptoms and signs</i>	<i>Progress if untreated</i>
4. Acute pericoronitis	Dull and continuous. Closure of jaws increases pain if impinging tooth is present.	Affected area. Lower third molar regions are the most common site.	To the ear on occasions.	Impinging upper molars. Inability to clean area efficiently. Upper respiratory infection.	Local application of heat. Analgesics	Continuous worse at mealtimes. Seldom prevents sleep.	Pyrexia, swelling, trismus, bad taste, foetor, dysphasia, tender lymph nodes	Infection may either resolve or spread or become chronic.
5. Dry socket	Dull, throbbing, continuous ache.	Site of an extraction performed 2-4 days previously	To the ear when lesion in lower jaw.	Touching affected area.	Local application of heat. Analgesics	Continuous worse at mealtimes. May prevent sleep.	Foetor oris. Involved bone is tender. Socket contains broken down blood clot.	May resolve in about 2 weeks or progress to sequestration.
6. Acute maxillary sinusitis.	Dull, throbbing, and continuous.	Infraorbital part of cheek and related upper teeth. Rarely occurs bilaterally.	Eye and temple on the affected side.	Jolting and bending forwards	Decongestant nose drops analgesics	Continuous and may prevent sleep.	Previous 'cold in head' pyrexia. Feeling fullness in cheek. Nostrils blocked. Related teeth tender to percussion. Tender on infraorbital pressure may complain of post nasal discharge. Enlarged tender lymph nodes.	May become chronic and cause chronic discharge.
7. Acute ulcerative gingivitis.	Dull, continuous pain. Touching lesions causes severe pain.	Affected areas of mouth.	May cross midline if affected areas do.	Patient generally runs down. Poor oral hygiene.	Analgesics	Continuous but seldom prevents sleep.	Mild pyrexia, foetor oris, bleeding gums. Unpleasant taste, tender lymph nodes, trismus, malaise.	Becomes chronic and destroys supporting tissues of teeth.

Appendix — 5

(Facial Swelling)

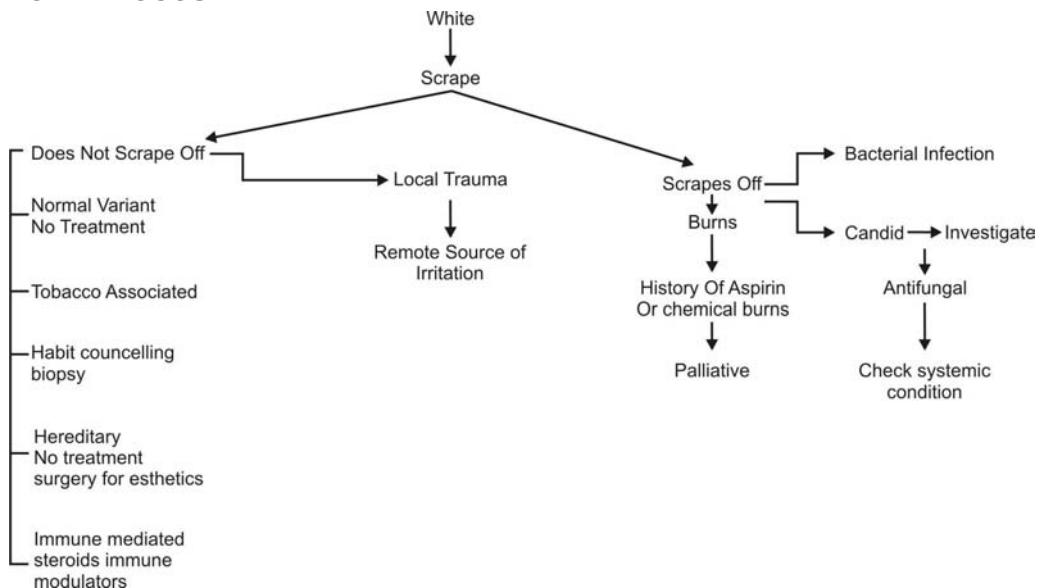
DECISION TREE FOR FACIAL SWELLING



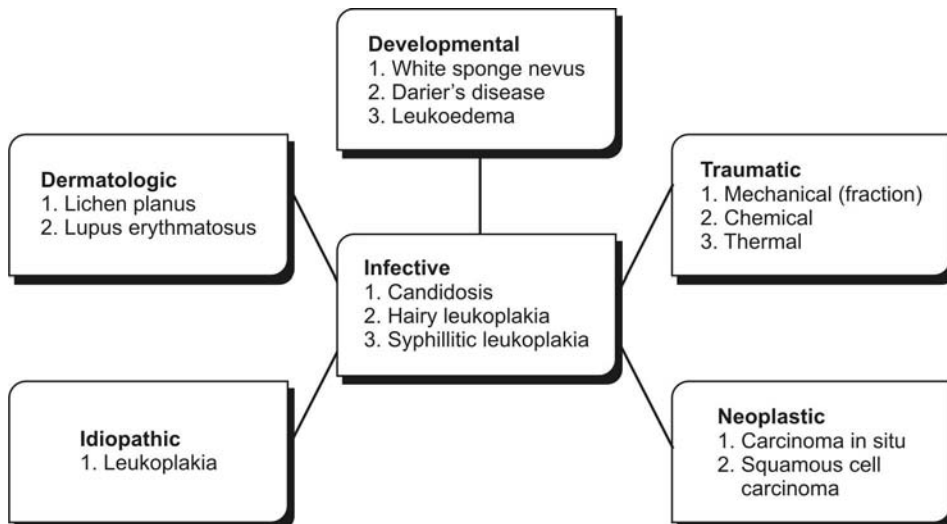
Appendix — 6

(White Lesions)

DIAGNOSIS OF WHITE LESION OF ORAL MUCOSA



DIFFERENTIAL DIAGNOSIS OF ORAL WHITE LESIONS



Appendix — 7

(Inability to Open Mouth)

CAUSES OF INABILITY TO OPEN MOUTH

Inability to open the mouth is caused due to many reasons as follows:

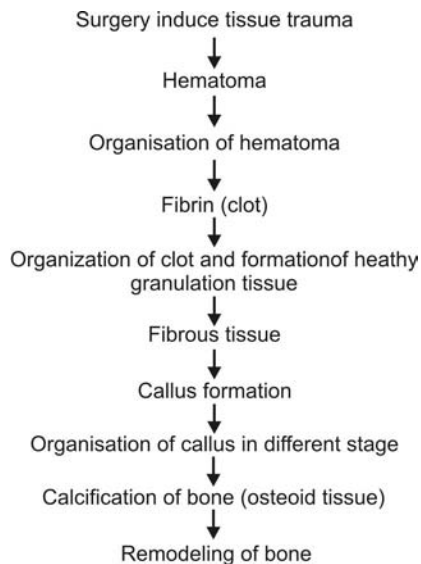
- I. Trismus: Which is muscle spasm caused due to:
 1. Odontogenic cause:
 - Infective (Periodontitis, pericoronitis, space infections, parotitis)
 - MPDS (Myofascial pain dysfunction syndrome) which is due to eruption of teeth or traumatic occlusion.
 2. Traumatic cause:
 - Fractured teeth and jaw bones.
 3. Neoplastic cause:
 - due to tumours eroding the muscles of mastication.
 4. Neurotoxic cause:
 - due to tetanus.
 5. Psychogenic cause:
 - due to hysteria.
 6. Pharmacological reason:
 - due to phenothiazine group of drugs.
- II. Pseudo-Ankylosis: This is a mechanical interference in the temporomandibular joint caused due to:
 1. Traumatic cause: Depressed fracture of the zygomatic arch resulting in the mechanical obstruction to the coronoid process.
 2. Hyperplastic cause: Hyperplasia of the coronoid process due to the short ramus or condylar deformity.
 3. Neoplastic cause: Due to any neoplasm of the coronoid process.
 4. others: Due to myositis ossificans or submucous fibrosis.
- III. False Ankylosis: This is Ankylosis of the TMJ caused due to extracapsular causes. It is caused due to:
 1. Infective causes:
 - Periarticular suppurations.
 2. Traumatic cause:-
 - Periarticular fibrosis
 - Dislocation of longer duration.
 3. Neoplastic cause:-
 - Neoplasm of the periarticular tissues.
 4. Others:-
 - Periarticular fibrosis following radiation.
- IV. True Ankylosis: This is ankylosis of the TMJ due to intra-articular causes. It is caused due to:
 1. Infective cause:
 - Regional spread of infection from middle ear (otitis media) and osteomyelitis of the mandible.
 - Hematogenous spread.
 2. Traumatic cause:
 - Intracapsular fracture resulting in hemarthrosis.
 - Penetrating wounds into the joint.
 - Birth injury during forcep delivery.
 3. Systemic cause:
 - Juvenile arthritis
 - Rheumatoid arthritis
 - Ankylosing spondylitis
 4. Neoplastic cause:-
 - Primary or metastatic tumors of the condyle.

Appendix — 8

(Healing of Wound)

HEALING OF WOUND

Theme of Healing



Healing of Bone (Three overlapping phases of bone healing, by Kruger)

1. Hemorrhage followed by organization of clot and proliferation of blood vessels- This is considered as a non-specific phase occurs during 0-10 days.

2. Callus formation- A rough woven bone or primary callus looks overlap is formed in the next 10-20 days. A secondary callus, which form Haverson systems during period of 3 weeks to 2 months.
3. Functional reconstruction - it takes 2 to 3 months.

Factors Influencing Wound Healing

1. Local factors:-
 - i. Infection — delays healing.
 - ii. Poor blood supply — delays healing.
 - iii. Foreign bodies — delays healing.
 - iv. Movement — delays healing.
 - v. Ionizing radiation — delays healing.
 - vi. Ultraviolet light — facilitates healing.
 - vii. Types, size and location of injury.
2. Systemic factors
 - i. Age — Increasing age delays healing.
 - ii. Nutrition — protein, vitamin C, zinc deficiency delays healing.
 - iii. Systemic injection — delays healing.
 - iv. Glucocorticoids — has anti inflammatory effect.
 - v. Uncontrolled diabetics — delays healing.
 - vi. Hematological abnormalities — delays healing.

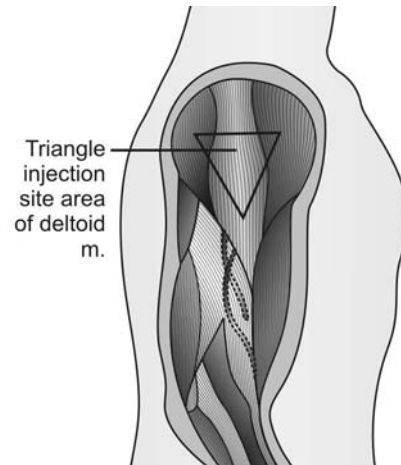
Appendix — 9

(Extraoral Injections)

TECHNIQUES FOR USE OF EXTRAORAL INJECTIONS

A dental surgeon should familiarize himself with the various techniques of the use of extraoral injections. This is especially helpful to inject IM, adrenaline in case of anaphylaxis and IV drugs in case of other emergencies like adrenal crisis. The various techniques are:

1. **Interdermal injection:** Injection is introduced just under the skin at an angle of 10° - 15° which will raise a small weal. The area should be massaged after removing the needle. The usual site of injection is the lightly pigmented area of the forearm where the reaction can be easily observed.
2. **Subcutaneous injections:** The folds of the skin are raised between thumb and forefingers and the needle is inserted at an angle of 45° . After insertion the plunger is withdrawn slightly to ensure a blood vessel has not been entered. In case of very short injection used for insulin, the needle enters the skin at 90° . The area is not massaged after withdrawing the needle but firm pressure is used to prevent hematoma formation. The usual sites for subcutaneous injection are the outer aspect of the upper arm, the outer aspect of the upper thigh and the skin of the abdominal wall.
3. **Intramuscular injections:** This is given to muscles so larger volume of solution can be injected (1-5 ml). The usual sites are the outer aspect of the thigh, locating the area in the middle third of the space between the knee and greater trochanter of the femur or the upper outer quadrant of the buttock. Alternatively the upper outer aspect of arm may be used if the muscle is big enough. While giving an intramuscular injection, the skin is held but and the needle is

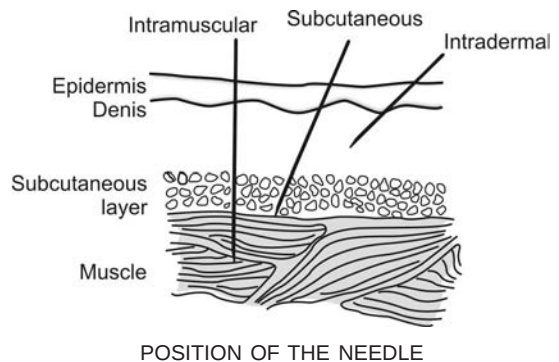
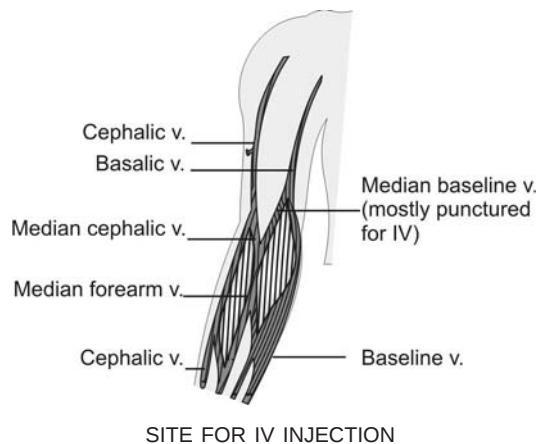


Site of IM injection

- introduced at 90° . As in the subcutaneous technique the plunger is withdrawn to check for inadvertent puncturing of a blood vessel. The fluid is injected slowly, the needle is withdrawn quickly, pressure applied initially and then the area massaged gently.
4. **Intravenous injections:** In case of intravenous injection proper care must be taken to maintain aseptic condition, proper injection drug and volume should be checked. Any air bubbles must be expelled from the barrel of the syringe before the needle is inserted into the tissues. The vein chosen for injecting should be large and strong, near the surface, not too freely movable, and should be capable of being rendered turgid by compression. If there are not fulfilled than the operator may fail to locate the veins, tear its wall or transfix it without realizing that the vein

has been entered. These mishaps cause unnecessary pain and brushing. The best site is within the bend of the elbow, where vein are usually visible and often confirm to one of the simple pattern as shown in Figure. The patients elbow is extended so that the vein is rendered turgid by compressing them proximally to the chosen site by hand pressure, a tourniquet, a piece of rubber tubing or sphygmomanometer cuff inflated to 80 mm of mercury. The patient clenches his fist a few times and the operator lightly taps the skin over the vein to distend it. The skin is punctured with the long axis of the needle lying parallel to the vein with its bevel uppermost. The point of the needle should be inserted through the skin at the site about 1 cm

distal to the place at which the vein is to be punctured and advanced alongside the vein before being introduced into the lumen. The plunger is withdrawn slightly to confirm entering into the lumen of the blood vessel and than the solution is injected slowly. The pressure over the forearm is released, an antiseptic swab is held over the site of puncture and the needle is withdrawn, pressure over the site of puncture reduces the risk of hematoma formation, but should not be exerted until the moment that the needle is withdrawn, or it will cause pain. Pressure must be maintained for a few minutes if bleeding and brushing are to be prevented and the patient can often hold the swab firmly in position by flexing his forearm.



Appendix — 10

(Cryosurgery, Laser Surgery and Electrosurgery)

CRYOSURGERY, LASER SURGERY AND ELECTROSURGERY USED IN ORAL AND MAXILLOFACIAL SURGERY

Cryosurgery

Controlled destruction of tissues by freezing is known as cryosurgery.

Types

1. Liquid nitrogen
2. Nitrous oxide
3. Carbon dioxide

Indication

1. Tumors with definable margins:
 - i. Nodular or ulcerated lesion.
 - ii. Instrument delineation by means of a curette.
 - iii. Chemical delineation by means of 5-fluorouracil
 - iv. Tumors overlying cartilage and bone
 - v. Lentigo maligna
2. Nature of the neoplasm:
 - i. Infected tumors
 - ii. Recurrent tumors from previous radiotherapy.
3. Patient with idiosyncrasies;
 - i. Patient with pacemaker.
 - ii. Patient with anesthesia idiosyncrasies
 - iii. Patient old enough for surgical risks.
4. In operable patients:-
 - i. Palliation
 - ii. Removal of bulk vegetative lesions.

Contraindications

1. Intolerance to cold.
2. Cryoglobulinemia.
3. Raynaud's disease
4. Cold urticaria

5. Collagen and autoimmune disease.
6. Concurrent treatment with renal diseases or immunosuppressive drugs.
7. Platelet deficiency disease
8. Blood dyscrasias of unknown origin.
9. Multiple myeloma.
10. Agammaglobulinemia.

Complications

1. Immediate:-
 - i. Pain during the freezing and thawing period.
 - ii. Headache affecting forehead, temples, and scalp.
 - iii. Insufflations of subcutaneous tissue
 - iv. Interdermal hemorrhage.
 - v. Syncope
 - vi. Vesicular - bullous formation.
 - vii. Edema
2. Delayed:-
 - i. Postoperative injections
 - ii. Febrile systemic reactions.
 - iii. Hemorrhage from the wound site.
 - iv. Pyogenic granuloma
 - v. Pseudo epitheliomatous hyperplasia.
3. Prolonged:-
 - i. Hyperpigmentation
 - ii. Development of milia
 - iii. Hypertrophy scars
 - iv. Neuropathy
4. Permanent:-
 - i. Hyperpigmentation
 - ii. Ectropion and notching of eyelids
 - iii. Notching and atrophy of tumor overlying cartilage.
 - iv. Tenting or notching of vermilion border of the upper lip.
 - v. Atrophy
 - vi. Alopecia of hair-bearing sites.

Laser Surgery

'LASER' stands for 'Light Amplification by Stimulated Emission of Radiation'. It is a device that emits an intense, coherent directional beam of radiation energy by stimulated electronic for molecular transitions to a lower energy levels.

Types

1. Carbon dioxide
2. Neodymium YAG (Nd : YAG)
3. Argon laser
4. Tunable dye laser

Advantages

1. Production of a sterile surgical field, bactericidal, virucidal.
2. Minimal cicatrix formation/ wound contraction.
3. Access too difficult to reach anatomic sites by reflection or through wave guides.
4. Ability to coagulate, vaporizes, or incise tissues.
5. Good hemostasis.
6. Reduced local tissue trauma and edema.
7. Precise delivery of energy to diseased tissue via microscopes for reduced damage to surrounding structure.
8. Reduced pain by induced neural anesthesia as a function of neuron sealing and decreased pain mediator release.
9. Minimized tumor cell dispersion by lymphatic sealing.

Disadvantages

1. Specialized didactic and clinically oriented instruction required for laser use by the surgeon and ancillary assistants.
2. Hazards to patients, operating and assistant team, and an anesthesia personal from misdirected and inadvertent laser radiation.
3. Expense of laser equipment
4. Specialized wiring and plumbing connection.
5. Maintenance requirement.
6. Fire hazard as related to anesthesia risk.
7. Electrical hazard of laser equipment.

Indications in Oral Surgery

1. To reduce and treat mucositis caused due to radiotherapy and chemotherapy.
2. Pain reduction.
3. To eliminate or reduce complications of postoperative paresthesia.
4. For treating sinusitis.
5. In combination with other treatment to treat TMJ arthritis.
6. To symptomatically treat tinnitus and vertigo patients.
7. Treat trigeminal neuralgia.
8. Treat post herpetic neuralgia.

Electrosurgery

Electrosurgery is the use of electrodes for various surgeries instead of manual scalpel cutting.

Armamentariums Needed

1. Dental electrodes.
2. Coagulating electrodes.
3. Periodontal loop electrode curette.
4. Fine needle electrode.
5. Diamond electrode.

Basic Requirements

1. Deftness with which the activated electrode is used.
2. Choice of appropriate radio-frequency current.
3. Use of proper amount of current power output.
4. Soundness of the treatment plan.

Uses in Dentistry

1. Desensitizing hypersensitive dentine.
2. Bleaching discolored teeth.
3. Exposing sub gingival and other tissue-occluded caries for definitive treatment.
4. Elongating clinical crown for improve esthetics.
5. Pulp capping.
6. Exposing the axial floors of proximal inlay preparations.
7. Surgical exposure of partly erupted permanent dentition.

Advantages

1. Electrosurgical cutting results from volatilization (vaporization) of the cells, hence bacteria, spores, fungi or yeasts that contaminate the surgical field are also volatilized and thus sterilization occurs during cutting.
2. Tissue cleavage is totally atraumatic.
3. Electro surgery with RF current seals capillaries producing hemostasis.
4. Absence of typical post operative sequelae such as pain, swelling and trismus.
5. Rapid uneventful healing by primary and secondary intention with scar formation.
6. Skin graft protection of the surgical site is not needed.
7. Healing is uniform throughout the depth of the wound.

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